MOBILE EQUIPMENT
AND WIND ENERGY SOLUTIONS

INDUSTRY PROCESS
AND AUTOMATION SOLUTIONS

BONFIGLIOLI
TRASMITAL

Installation, use and service manual

GB

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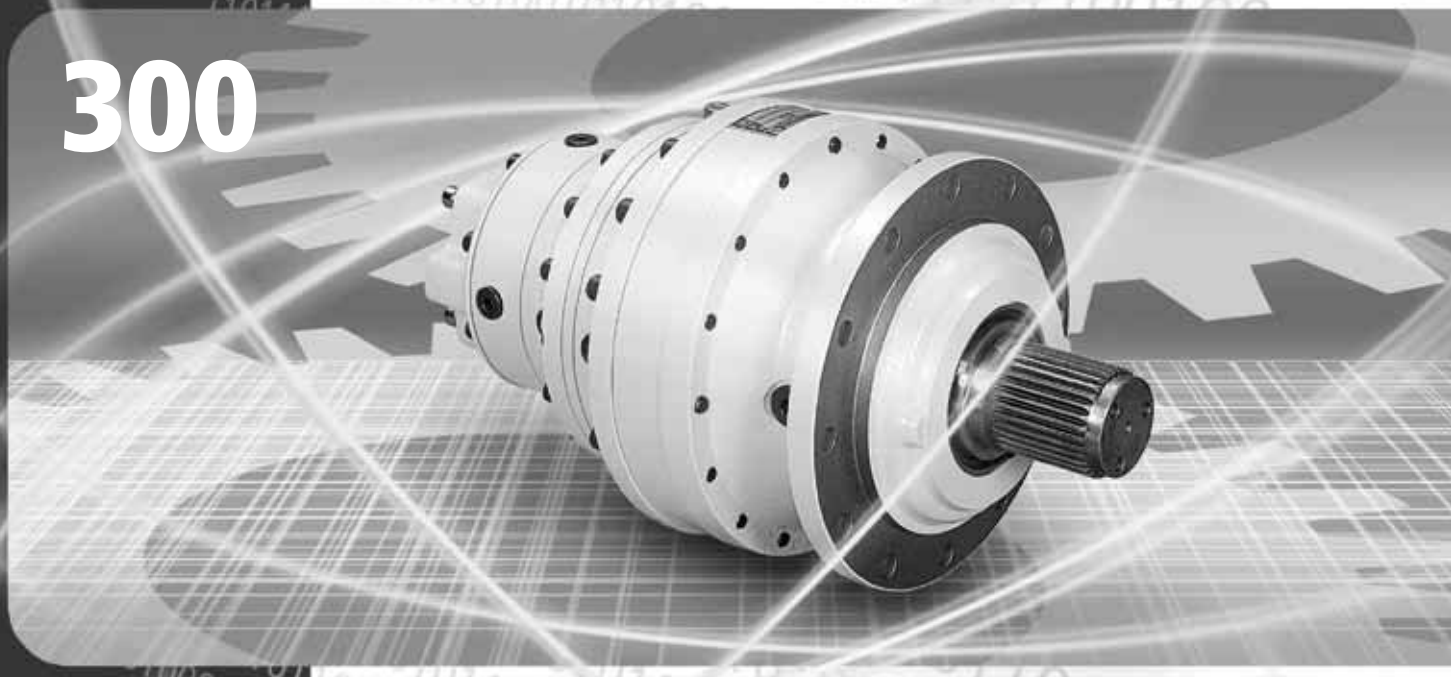

ATEX
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BONFIGLIOLI

USE, INSTALLATION AND MAINTENANCE MANUAL

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Revisions
The catalogue revision list is given on page 42. The most recent versions of the catalogue are available at www.bonfiglioli.com.

1.0 - GENERAL INFORMATION

1.1 - PURPOSE OF THE MANUAL

This Manufacturer's manual provides information regarding the safe transport, handling, installation, maintenance, repair, disassembly and dismantling of the gear unit.

All information for users and designers is given in the Sales Catalogue. As well as adhering to established engineering practices, the information given in this manual must be read carefully and rigorously applied.

Failure to observe the information provided herein may result in risks to personal health and safety, as well as economic damages.

This information, provided in the Manufacturer's original language (Italian), is also available in other languages to meet legal and commercial requirements.

The documentation must be stored by a person charged to do so in a suitable location so as to be always available in good condition for consultation.

In case of loss or damage, replacement documentation must be requested directly from the Manufacturer, quoting the code of this manual.

This manual reflects the state of the art at the time of commercialisation of the gear unit.

The Manufacturer reserves the right to modify, supplement and improve the manual, without the present publication being for that reason considered inadequate.

Particularly significant sections of the manual and important specifications are highlighted by symbols whose meanings are explained below.

SYMBOLS:

DANGER - WARNING

This symbol indicates situations of danger, which if ignored, may result in serious injury to the operator.

CAUTION - ATTENTION

This symbol indicates the need to adopt specific precautions to avoid personal injury and damage, as well as economic damages.

IMPORTANT

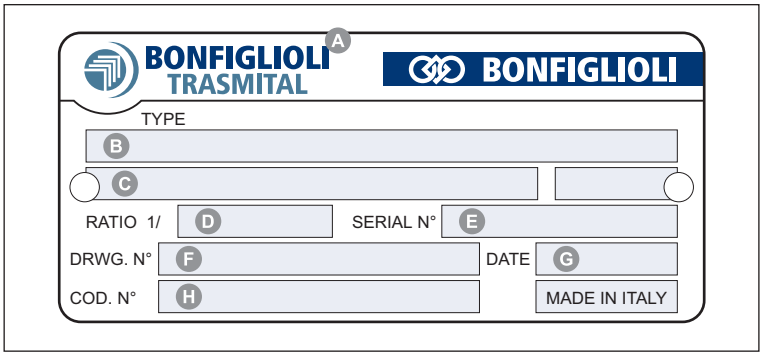
This symbol indicates important technical information.

Instructions marked by these symbols and highlighted in yellow, apply exclusively to equipment complying with "ATEX" Directive 94/9/EC.
The operations identified by these symbols must be executed by professionally qualified operators specially trained in the safety precautions required for working in potentially explosive atmospheres.
Failure to observe these instructions may result in serious safety and environmental risks.

1.2 - PRODUCT IDENTIFICATION

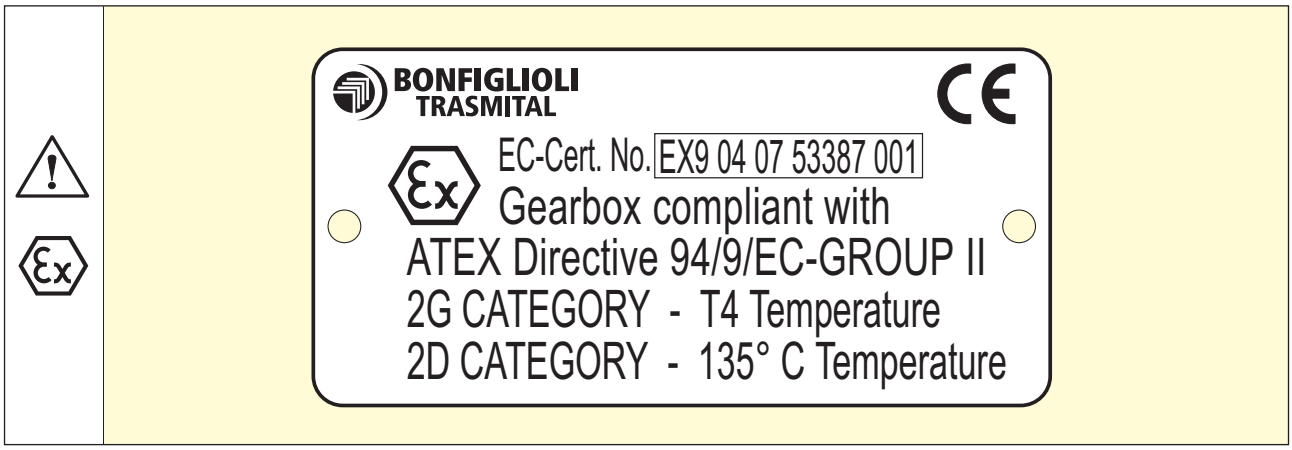
The information identifying the product is shown on its nameplate. Gearmotors are equipped with two nameplates; one on the gear unit which bears the gear unit data, and one on the motor (electric or hydraulic), bearing the motor data.
The drawing below illustrates the layout of the data.
The gear unit's identifying code is explained in the Sales Catalogue. If the gear unit is supplied fitted with an electric motor (gearmotor), all information regarding the motor is supplied in the motor manual.

Nameplate data



- A Manufacturer
- B Product identification
- C Bonfiglioli Trasmital product code
- D Reduction ratio
- E Serial number
- F Installation drawing code.
- G Date of manufacture
- H Client product code

Supplementary nameplate on ATEX-specified gear units


BONFIGLIOLI TRASMITAL
CE
EC-Cert. No. EX9 04 07 53387 001
Gearbox compliant with
ATEX Directive 94/9/EC-GROUP II
2G CATEGORY - T4 Temperature
2D CATEGORY - 135° C Temperature

Readability of the nameplate

The nameplate and the information on it must be readable and, consequently must be cleaned from time to time.

Quote the nameplate data in all communications with the manufacturer, for example, when requesting spare parts, information and assistance.

1.3 - GLOSSARY AND TERMINOLOGY

Some of the frequently occurring terms used in this manual are described below to unequivocally define their meaning.

Routine maintenance
The set of operations required to preserve the functionality and efficiency of the gear unit. These operations are usually scheduled by the Manufacturer, who defines the qualifications and tasks involved.

Reactive maintenance
The set of operations required to preserve the functionality and efficiency of the gear unit. These operations are not scheduled by the Manufacturer and must be carried out by an expert maintenance technician.

Expert maintenance technician
An authorised technician with the qualifications, skills and mechanical and electrical training required to do repairs and non-routine maintenance work on the gear unit.

Overhaul
An overhaul consists in the replacement of bearings and other mechanical components which have worn to such an extent as to compromise the operation of the gear unit. An overhaul also includes verification of the condition of all gear unit components (keys, seals, gaskets, vents, etc). If any such components are damaged they must be replaced and the reason for the damage identified.

1.4 - REQUESTING TECHNICAL ASSISTANCE

For any technical service needs, contact the Manufacturer's sales network quoting the information indicated on the unit's nameplate, the approximate hours of service and the type of defect.

1.5 - MANUFACTURER'S LIABILITY

The Manufacturer declines all liability in the event of:

- use of the gear unit in contravention of local safety at work legislation
- incorrect installation, disregard or incorrect application of the instructions provided in this manual
- incorrect or defective electrical/hydraulic power supply (gearmotors)
- modifications or tampering
- work done on the unit by unqualified or unsuitable persons.

The safety of the gear unit also depends on scrupulous observance of the instructions given in this manual, and in particular:

- always operate the unit within its operating limits
- diligently observe the routine maintenance schedule
- only allow trained operators to inspect and service the unit
- only use original spare parts

- the configurations given in the gear unit catalogue are the only ones permitted
- do not attempt to use the unit in any other way
- the instructions given in this manual do not substitute but rather supplement the provisions of established safety legislation.

1.6 - CONSIGNMENT CONDITIONS

Gear units are supplied by BONFIGLIOLI TRASMITAL in the following conditions:

- Configured for installation in the mounting position specified in the purchase order.
- Not charged with lubricant and with internal components protected by a film of oil compatible with the recommended lubricant.
- All surfaces and mating parts are treated with rustproofing products.
- Mating surfaces are not painted while the unit's exterior is treated with a coat of grey water-based rustproofing primer (RAL 7042/C441). Application of a top coat is the responsibility of the Client.
- Tested to factory standards.
- Packaged suitably for the final destination.

2.0 - TECHNICAL INFORMATION

2.1 - DESCRIPTION OF THE GEAR UNIT

The gear unit, driven by an electric or hydraulic motor, has been designed and constructed for integration into an assembly of interlocking parts or mechanisms as part of a specific application.
Depending on the requirements of the application, the gear unit can be supplied in a variety of motor executions and configurations. It is capable of satisfying a range of specific requirements in the mechanical, chemical, agricultural and food industries, etc.

BONFIGLIOLI TRASMITAL supplies a range of accessories and optionals to make their products as versatile as possible. For further technical information and descriptions, refer to the corresponding Sales Catalogue.
The User is responsible for using the products recommended for installation and maintenance of

SAFETY SPECIFICATIONS OF GEAR UNITS COMPLYING WITH DIRECTIVE 94/9/EC

- unit selection must be made with a higher safety service factor
- use only synthetic lubricants (oil and grease)
- VITON® seal rings
- vent plugs with spring-loaded anti-intrusion valve
- oil plugs with aluminium washer
- oil seals with dust trap
- no metal moving parts external to the gear unit
- no plastic parts capable of building up an electrostatic charge, or, if present, duly shielded
- for installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme for all surfaces and recesses to avoid dust build ups of more than 5 mm in depth.

2.2 - CONFORMITY

All gear units or gearmotors (when supplied with electric motor) are designed in compliance with the provisions of applicable Essential Health and Safety Requirements, the “Machinery Directive” 98/37/EC and, if requested, can be supplied with a Manufacturer’s Declaration - Annex IIB as provided by said Directive.
All BONFIGLIOLI gearmotor electric motors conform to the provisions of the Low Voltage Directive 73/23/EEC and the Electromagnetic Compatibility Directive 89/336/EEC.

Furthermore, if specified for use in potentially explosive atmospheres, the gear units are designed and constructed to conform with the Essential Health and Safety Requirements (EHSR) of Annex II of the ATEX Directive 94/9/EC and conform to the following classification:

- Equipment group: **II.**
- Category: Gas **2G** - Dust **2D.**
- Zone: Gas **1** - Dust **21.**
- Maximum surface temperature: temperature class **T4** for 2G and **130°C** for 2D.

2.3 - OPERATING LIMITS AND CONDITIONS

Modification of the motor execution or mounting position is only permitted if previously authorised by BONFIGLIOLI TRASMITAL’s Technical Service.

Failure to obtain said authorisation renders the ATEX certification null and void.

Ambient conditions

- Ambient temperature: min. - 20°C; max. + 40°C.
- Do not use the gear unit, if not explicitly intended for the purpose, in a potentially explosive atmosphere or where the use of explosion-proof equipment is specified.

The nameplate specifications regarding the maximum surface temperature, refer to readings taken in normal ambient and installation conditions.
Even minimal variations to said conditions (e.g. smaller mounting cabinet) may have a significant effect on the unit's heat output.

- Lighting

If the unit is to be serviced in a poorly lit area, use additional lamps and ensure that the work is done in compliance with the safety requirements of established legislation.

3.0 - SAFETY INFORMATION

3.1 - SAFETY STANDARDS

- Carefully read the instructions given in this manual and those posted directly on the gear unit, especially those regarding safety.
- Persons charged with working on the gear unit at any time in its service life must be trained specifically for the purpose with special abilities and experience in the area as well as being equipped with the appropriate tools and individual safety equipment (as per Legislative Decree 626/94). Failure to meet these requirements constitutes a risk to personal health and safety.
- The gear unit must only be used for the applications permitted by the Manufacturer. Improper use can result in risks to personal health and safety and economic damages.

The applications permitted by the Manufacturer are the industrial applications for which the gear units have been designed.

- Keep the gear unit at its maximum efficiency by following the routine maintenance schedule. Good maintenance ensures the unit's maximum performance, extended service life and continued compliance with safety regulations.
- When working on the unit in areas which are difficult to access or hazardous, ensure that adequate safety precautions have been taken for the operator and others in compliance with established legislation on health and safety at work.
- All maintenance, inspection and repairs must only be carried out by an expert maintenance technician fully familiar with the attendant hazards. It is therefore essential to implement operating procedures that address potential hazards and their prevention for the entire machine. The expert maintenance technician must always work with caution in observance of applicable safety standards.
- During operation wear only the apparel and safety equipment indicated in the User Instructions provided by the Manufacturer or stipulated by legislation on safety at work.
- Replace worn components with original spare parts. Use the lubricants (oil and grease) recommended by the Manufacturer.
- Do not dump polluting materials into the environment. Dispose of all such materials as stipulated by applicable legislation.
- After replacing lubricants clean the gear unit's surfaces and the walk-on surfaces around the work area.

If the gear unit is to be serviced in a potentially explosive atmosphere, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning.
Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc).

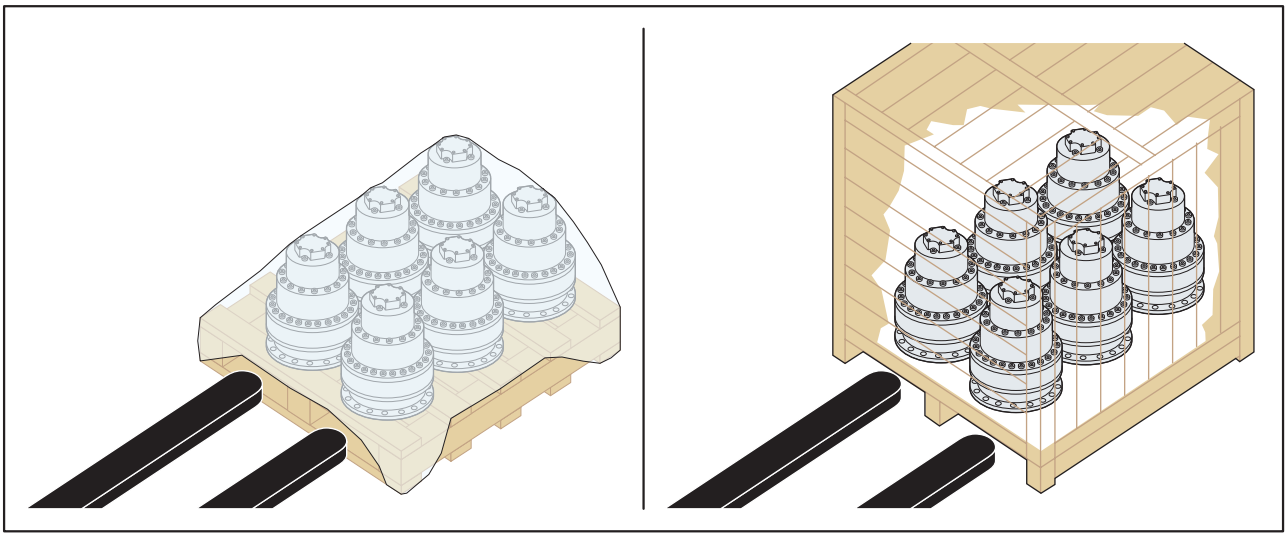
4.0 - HANDLING AND TRANSPORT

4.1 - PACKAGING

The standard packaging, if supplied and unless otherwise agreed, is not proofed against rainfall and is intended for shipping by ground and not sea, and for storage in areas which are under cover and not humid. The material can be stored in suitable conditions for a period of two years under cover at a temperature between -15 °C and +50 °C at a relative humidity not in excess of 80%. Storage in all other conditions requires specific packaging.

The most frequent types of packaging are shown in the figures below.

- Packaging on pallet with heat shrink film for ground shipping.
- Packaging in wooden crate for shipping by sea or air.



On receipt of the gear unit, make sure the delivery corresponds to the purchase order and that it is not damaged or faulty in any way.
Report any nonconformity to your BONFIGLIOLI TRASMITAL reseller.

Dispose of packaging materials as stipulated by applicable legislation.

4.2 - HANDLING INSTRUCTIONS

Handle packages as per the Manufacturer's instructions and those marked on the packages themselves. Since the weight and shape of the packages may make manual handling unfeasible, special equipment must be used to avoid damage and injury. Persons authorised for this purpose must be trained and experienced in the work in question to avoid risks to themselves and others.

The person authorised to handle the product must take all necessary precautions to safeguard his safety and that of all other persons involved.

4.2.1 - Moving the packages

- Prepare a suitable, delimited area with a level floor or surface for unloading the packages.
- Prepare the equipment required to handle the package. The lifting and handling equipment (e.g. crane or lift truck) must be of adequate capacity for the weight and size of the load, taking into account its attachment points and centre of gravity. If required, this information is indicated on the package itself. Harness heavy packages with chains, belts and steel ropes after checking that they are suitable for the weight of the load, which is always indicated.
- When handling the load keep it level to avoid tipping and instability.

4.2.2 - Moving the equipment

All the following operations must be carried out with care and caution and without sudden movements.

When lifting, use accessories such as eyebolts, screw clamps, snap hooks, straps, ropes and hooks etc. which are certified and adequate for the load in question.
The weight of the product to be lifted is given in the Sales Catalogue.

The following pages illustrate in detail the different attachment methods for the various product series, sizes and configurations described in this Manual.
The most suitable solution for lifting and handling the product in safety is indicated for each.

Symbols:

Type of lifting	**Manual**	**With mechanical equipment**	
Symbol	**M**	**A**	**B**
Approximate weight	≤ 15 Kg	> 15 Kg	
Instruction	—	Recommended method for positioning	Recommended method for handling and positioning
Warning	—	The load may be unstable	The load may sway or oscillate
Solution	—	Slide the lifting ring to align it with the load's centre of gravity as shown in the diagrams below Lock the ropes below the ring with a cable clamp or similar device so as to prevent them sliding, and lift the load Observe all precautions regarding the handling of loads	Stabilise the moving load by hand Observe all precautions regarding the handling of loads

The load must not be allowed to sway by more than 15° in any direction when being lifted.
If swaying exceeds this amount, stop and repeat the lifting operation as instructed.

Identify the attachment points for lifting the gear unit. Refer to the diagrams given below.

A 300 L ... 316 L

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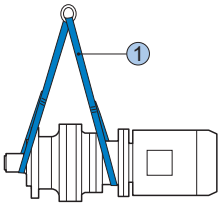

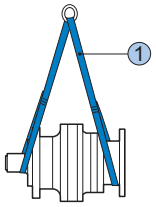

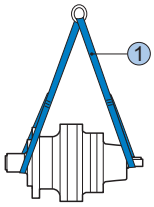

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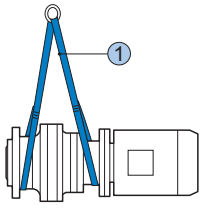

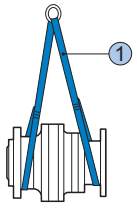

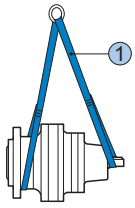

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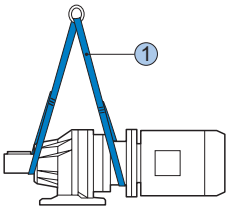

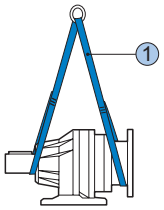

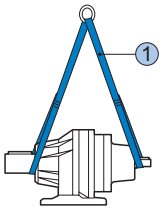

B 317 L ... 321 L

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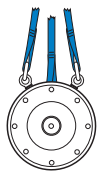

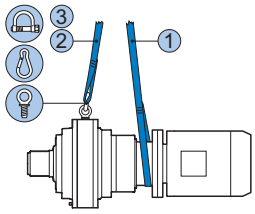

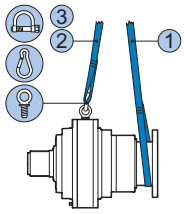

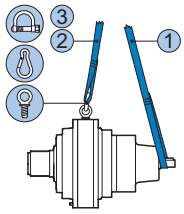

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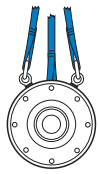

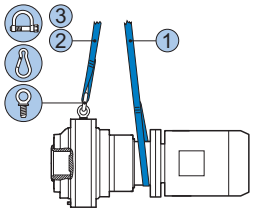

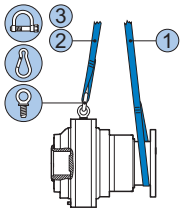

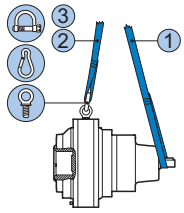

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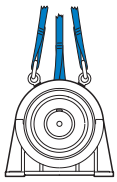
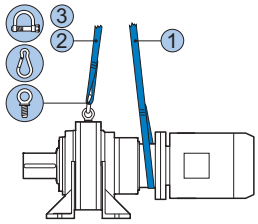
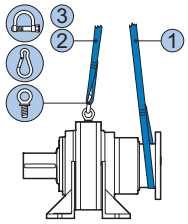
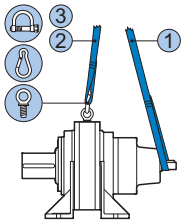








① Ring harness

② Rope and hooks

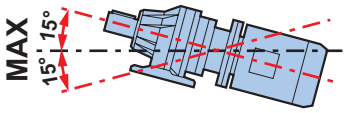
③ Open harness with eyelets

Screw clamp (use with harness)

Snap hook (use with rope)

Eyebolt (already fitted on gear units 317-321)

Maximum permissible tilt during handling: 15°



A 300 R ... 316 R

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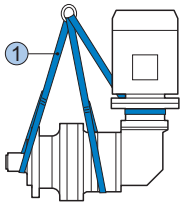
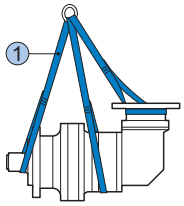
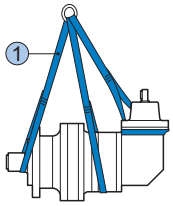

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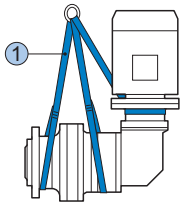
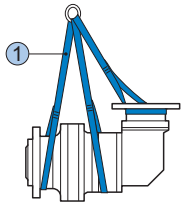
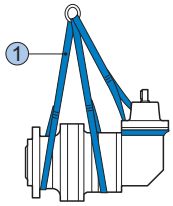

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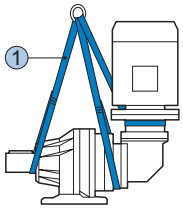
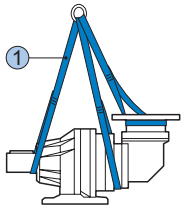
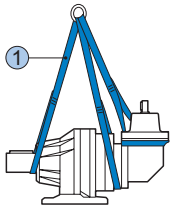

B 317 R ... 321 R

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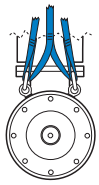
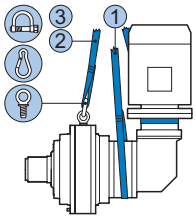
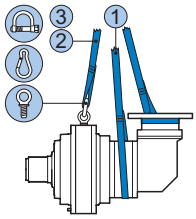
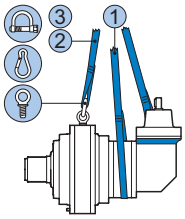

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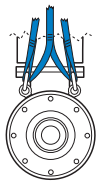
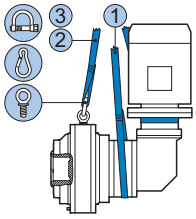
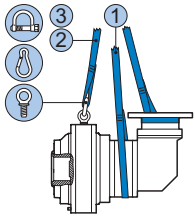
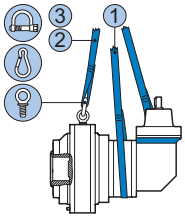

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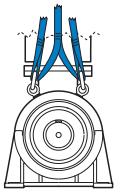
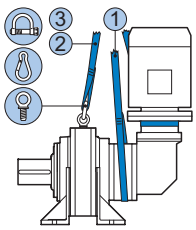
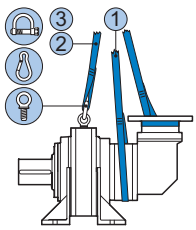
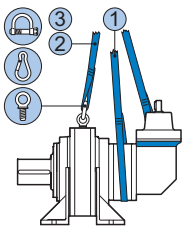





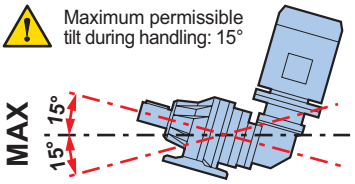
1. Ring harness
2. Rope and hooks
3. Open harness with eyelets

Screw clamp (use with harness)

Snap hook (use with rope)

Eyebolt (already fitted on gear units 317-321)

Maximum permissible tilt during handling: 15°



A 300 R ... 316 R

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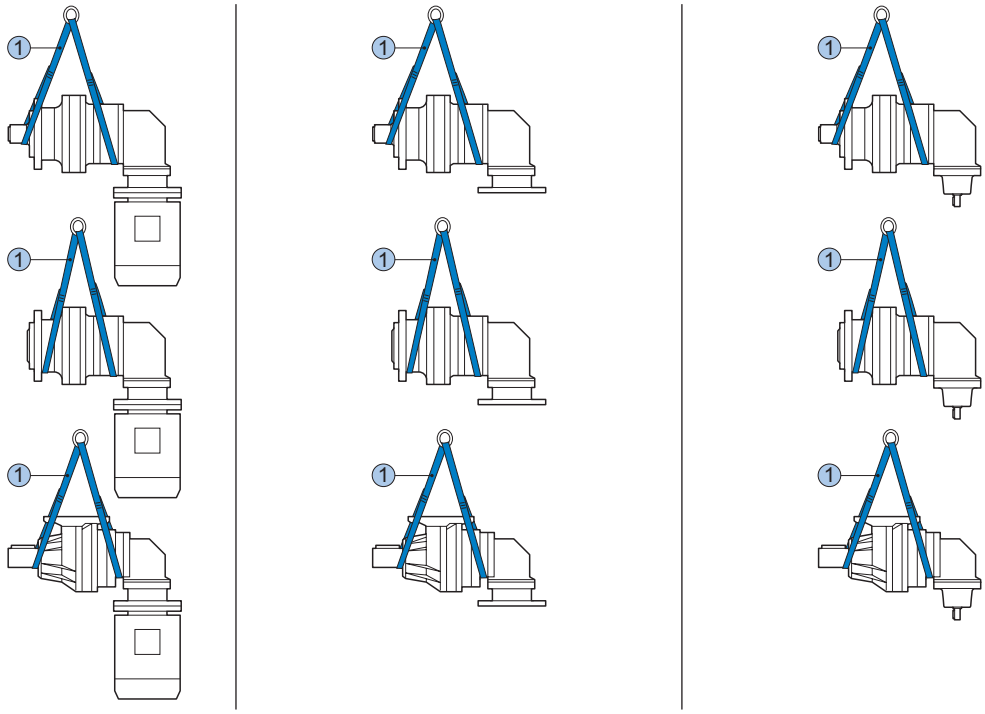

B 317 R ... 321 R

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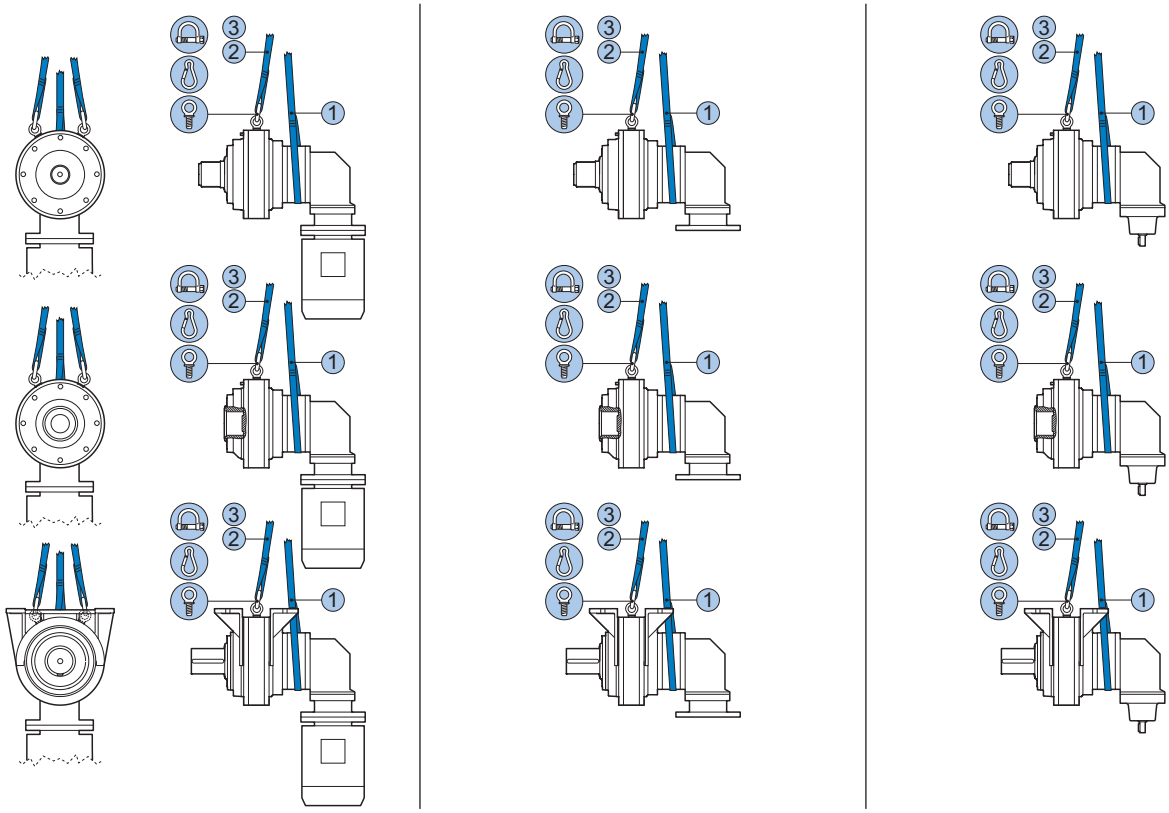

1 Ring harness

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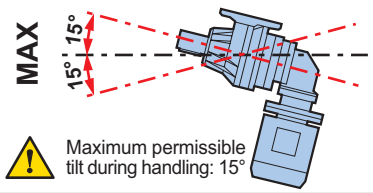

Maximum permissible tilt during handling: 15°

A 3V 00 ... 3V 16

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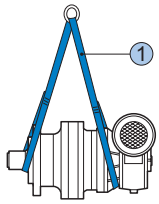

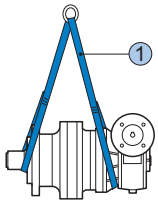

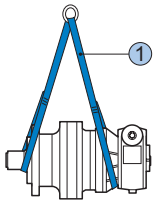

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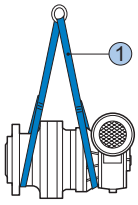

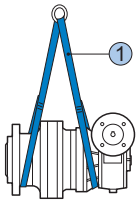

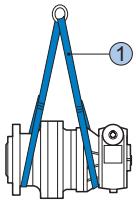

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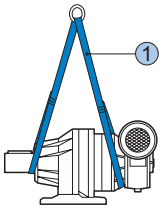

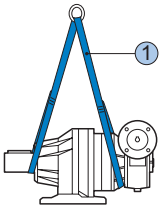

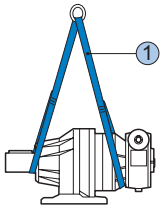

B 3V 17 ... 3V 21

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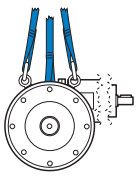

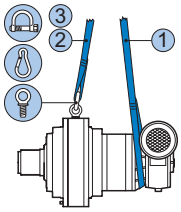

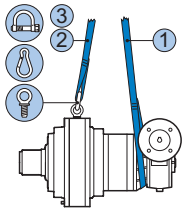

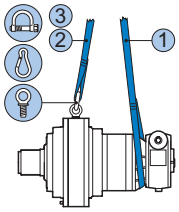

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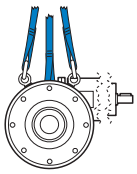

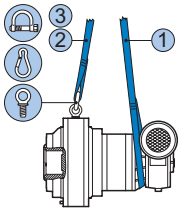

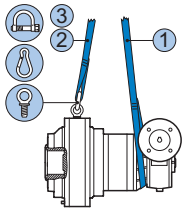

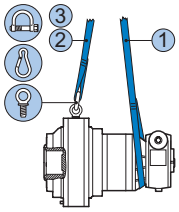

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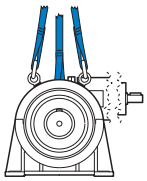
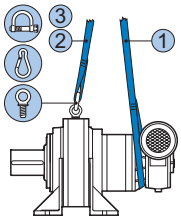
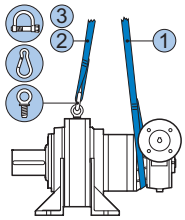
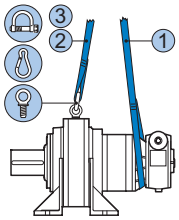








① Ring harness

② Rope and hooks

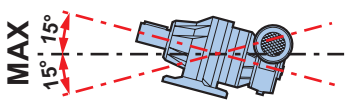
③ Open harness with eyelets

Screw clamp (use with harness)

Snap hook (use with rope)

Eyebolt (already fitted on gear units 317-321)

Maximum permissible tilt during handling: 15°



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300 L ... 321 L

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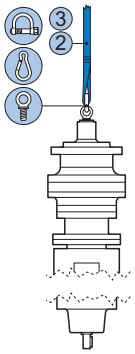

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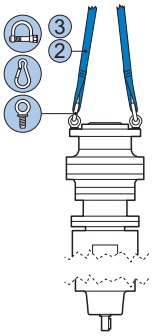

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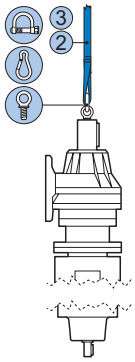

300 R ... 321 R

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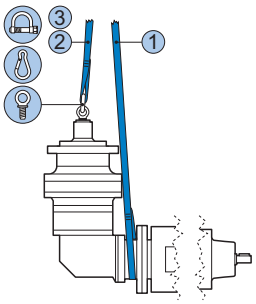

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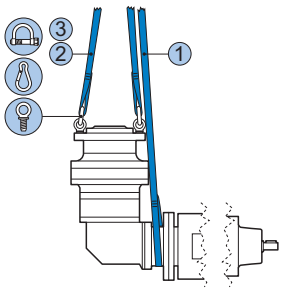

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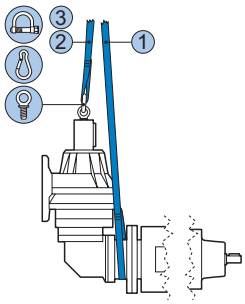
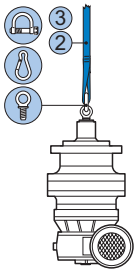
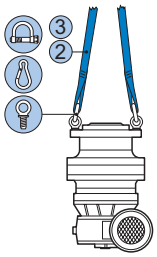


3V 00 ... 3V 21

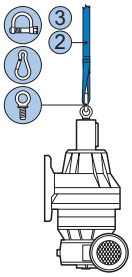
H□



F□



P□



① Ring harness

② Rope and hooks

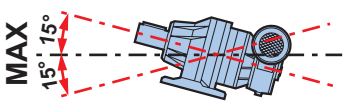
③ Open harness with eyelets

Screw clamp (use with harness)

Snap hook (use with rope)

Eyebolt (already fitted on gear units 317-321)

Maximum permissible tilt during handling: 15°



- Prepare the gear unit for lifting by attaching straps, hooks and screw clamps etc. to its attachment points. Alternatively, use a pallet to move the load. If using a crane, first lift the gear unit vertically out of its packaging.
- If using a lift truck or pallet truck, remove the packaging and insert the truck's forks at the indicated positions.
- First lift the load very slowly to check that it is stable.
- Move the gear unit to the unloading area and lower it gently into position, taking care not to tip it suddenly in transit.

If the gear unit is already equipped with an electric motor, do not use the eyebolts on the motor casing for lifting, unless expressly specified.

4.3 - STORAGE

The following recommendations should be followed when storing the gear unit.

1. Do not store the unit in excessively humid conditions or where it is exposed to the weather (do not store outdoors).
2. Do not place the gear unit directly on the ground.
3. Place the gear unit on a stable base and make sure that it is not subject to accidental displacement.
4. Store the packaged gear unit (if allowed) in accordance with the instructions on the packaging itself.

If the gear unit is to be stored for more than 6 months, the following **additional** precautions must be taken:

5. Cover all machined external surfaces with a rustproofing product such as Shell Ensis or other product with similar properties and application range.
6. Fill the unit with lubricating oil and make sure the vent plug is positioned uppermost. Before putting the unit into service, the oil used for storage must be drained and replaced with the correct quantity of recommended operating lubricant.

PRECAUTIONS to be taken when returning the gear unit to service after storage.

The output shafts and external surfaces must be thoroughly cleaned of all rustproofing product, contaminants and other impurities (use a standard commercial solvent).
Do this outside the explosion hazard area.

The solvent must not touch the seal rings as this may damage them, causing them to leak

If the oil or protective material used during storage is not compatible with the synthetic oil used during the machine's operation, the interior of the unit must be thoroughly cleaned before filling with the operating oil.

The service life of the bearing grease is reduced if the unit is stored for more than 1 year.
The bearing grease must be synthetic.

5.0 - INSTALLATION

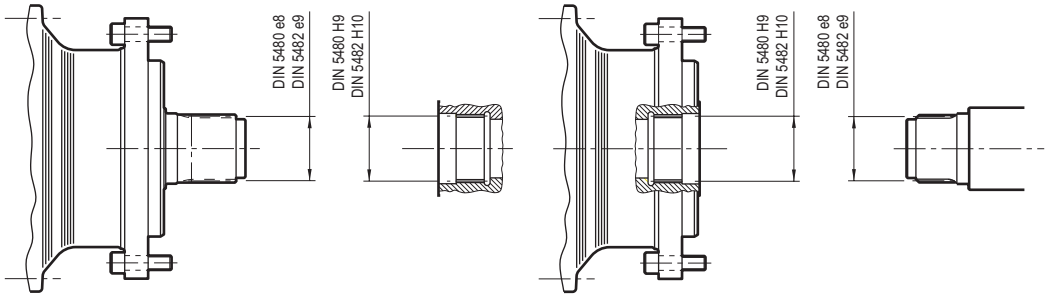
5.1 - INSTALLING THE GEAR UNIT

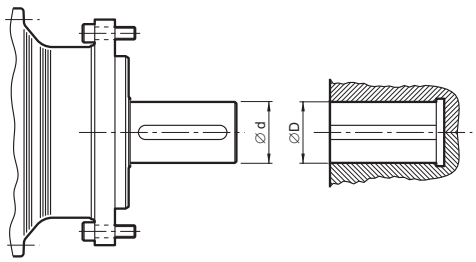
The entire installation process must be planned as early as the general design phase of the machine. The person authorised to do the work must, if necessary, set out a safety plan to protect the health and safety of all persons directly involved and apply all applicable legislation.

1. Carefully remove all packaging and protective product residue from the gear unit.
   Pay particular attention to the mating surfaces.
2. Check that the data on the nameplate correspond to those specified in the purchase order.
3. Ensure that the structure to which the gear unit is to be mounted is sufficiently robust and rigid to support its weight and operating stresses.
4. Check that the machine to which the gear unit is to be installed is switched off and cannot be accidentally switched on again.
5. Make sure all mating surfaces are flat.
6. Make sure the shaft/shaft or shaft/ bore are perfectly aligned for coupling.
7. Fit suitable guards to protect against the gear unit's external moving parts.
8. If the work environment is corrosive for the gear unit or any of its parts, follow the special precautions required for aggressive environments. In this case, contact the BONFIGLIOLI TRASMITAL sales service.
9. We recommend applying a protective paste to all gear unit/motor mating surfaces and other parts (Klüberpaste 46 MR 401 or other product with similar properties and application range) to ensure optimal coupling and protection against fretting corrosion.
10. In the case of outdoor installations fitted with an electric motor, protect the latter from direct sunlight and the weather by means of guards or a casing. Also make sure that the assembly is properly ventilated.

5.1.1 - Flanged execution

Machine the coupling counterflange on the machine to which the gear unit is to be installed.
The flanges must be plane and machined with machine tools. Connect the output shaft to the driven component as indicated in the drawings below.





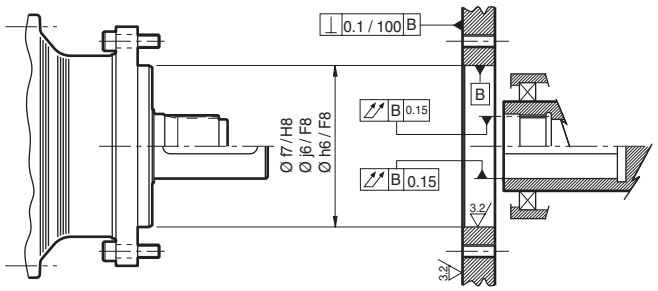
Recommended tolerances

Loose coupling		Coupling with interference	
Solid shaft	Hollow shaft	Solid shaft	Hollow shaft
Ø d h6	Ø D G7	Ø d h6	Ø D P7
Ø d k6	Ø D F7	Ø d k6	Ø D M7
Ø d m6	Ø D F7	Ø d m6	Ø D K7
Ø d r6	Ø D E7	Ø d r6	Ø D H7

For machining the spigot on the driven machine, refer to the diagrams below:

300...307 gear units - male output shaft motor execution

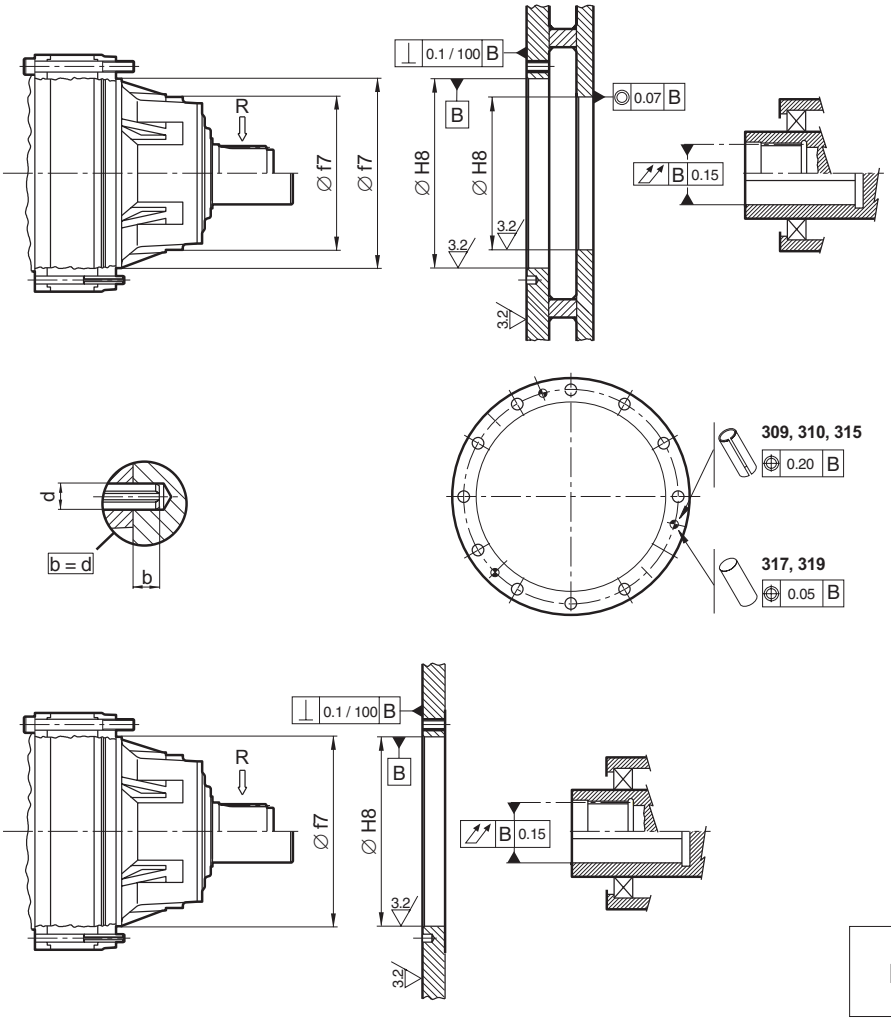
300...307



309...321 gear units - male output shaft motor execution

These gear units are fitted with two spigots. When machining the coupling flanges, one spigot may be sufficient if the output shaft is not subject to overhung loads or loads are less than 60% of the permissible load.
For heavier loads, the mounting must use both spigots on the gear unit.
If the gear unit is instead required to transmit high torque or is subject to heavy shock loads and inversions in the direction of rotation, the counterflange must be drilled to accept the spigots.
At the time of installation, move the spigots mounted on the gear unit forward into the counterflange by an amount equal to their diameter. See diagram below:

309...321

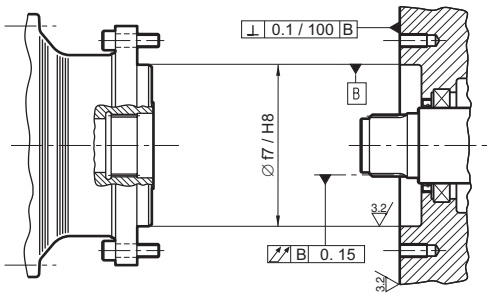


R ≥ 60% Rn

Mounting with hollow splined shaft

Ensure that the gear unit and driven shaft are aligned and that the latter is not subject to flexing during operation. See diagram below:

300...321



Flanged gear unit mounting bolts

	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M10	M10	M12	M12	M12	M14	M16	M16	M16	M16	M20	M20	M20	M20	M30	M24	M30	M30
Quantity	8	8	10	10	10	12	10	12	15	24	30	20	20	30	24	32	30	36
Class	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Tightening torque (Nm)	50	50	85	85	85	135	200	200	200	200	400	400	400	400	1400	700	1400	1400

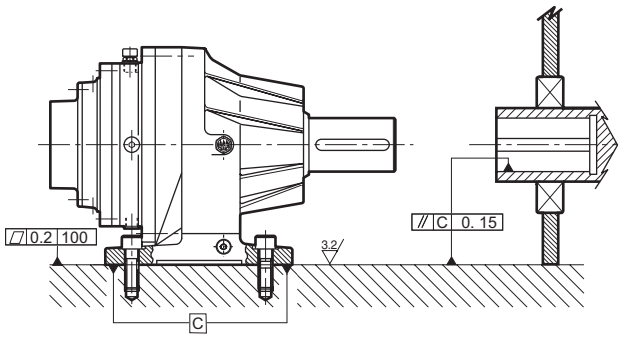
For maximum transmitted torques greater than or equal to 70% of the torque indicated as M_{2max}, and with frequent inversions of the direction of rotation, use at least class 10.9 bolts.

5.1.2 - Foot mounting

Foot-mounted motor execution

Gear units of this type must be mounted on a suitably rigid base, machined flat with a planarity error margin of no more than 0.2 mm / 100 mm.
See diagram below:

300...321



Foot-mounted gear unit mounting bolts

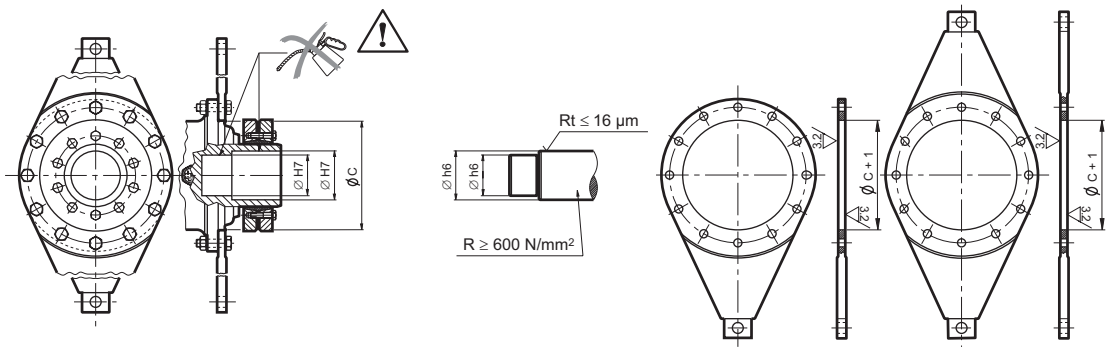
	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M16	M16	M16	M16	M16	M20	M24	M24	M24	M30	M30	M30	M30	M36	M30	M36	M48	M48
Quantity	4	4	4	4	4	4	4	4	4	4	4	8	8	8	8	8	4	8
Class	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Tightening torque (Nm)	200	200	200	200	200	400	700	700	700	1400	1400	1400	1400	2500	1400	2500	6000	6000

5.1.3 - Shaft mounting

Mount the torque arm with bolts of at least class 8.8 tightened to a torque of 70% of their failure stress. Clean and degrease both the internal coupling surface of the gear unit shaft and the external coupling surface of the machine's driven shaft.
Mount the shrink disk to the gear unit's shaft after lightly lubricating its entire **outer surface**. Snug down a first set of 3 bolts located at the corners of an equilateral triangle (for example: bolts in pos. 1-5-9 of the diagram below). Fit the gear unit to the driven shaft.
Tighten down the bolts (following the triangular pattern) in a circular direction, repeating the operation several times until all bolts are tightened to the torque specified in chart 2, in accordance with the type of disk/gear unit.

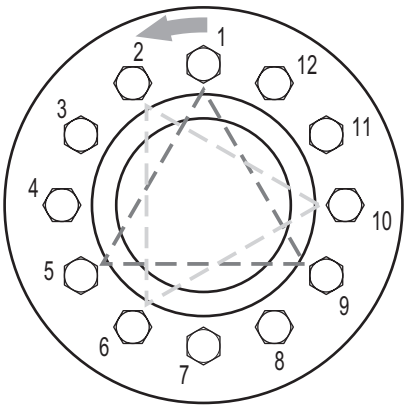
N.B.: Do not tighten down diametrically opposed bolts in sequence.

300...321



Do not use molybdenum bisulphide or any other grease, which could reduce the friction of the mating surfaces and affect the performance of the shrink disk.

300...321



Shrink disk mounting bolts

	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M6	M6	M8	M8	M8	M10	M10	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M24
Quantity	8	10	12	12	12	9	12	8	8	10	10	12	12	15	18	21	24	21
Class	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
Tightening torque (Nm)	12	12	30	30	30	58	58	250	250	250	250	490	490	490	490	490	490	840

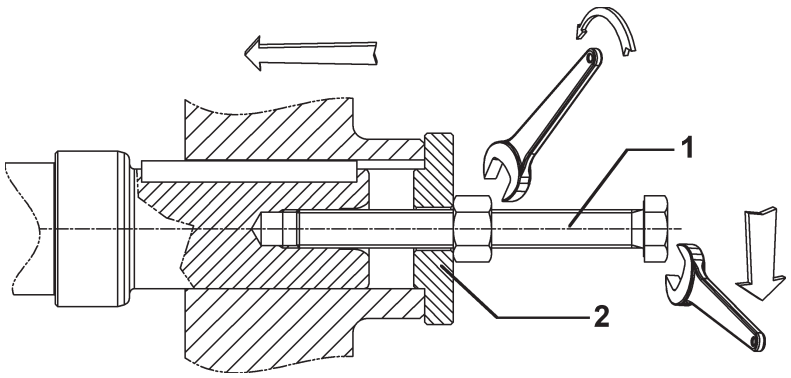
Proceed with the installation as follows:

1. Place the gear unit in the vicinity of the installation area.
2. Mount the gear unit and secure it to the structure at the points provided. The gear unit should be secured to the structure at all the mounting points (bores) on the mount provided (feet or flange).
3. Tighten down the mounting bolts and check that the service plugs are screwed down to the torques given in the chart.

Locate the closed oil plug used during shipping and replace it with the vent plug supplied in the shipment.

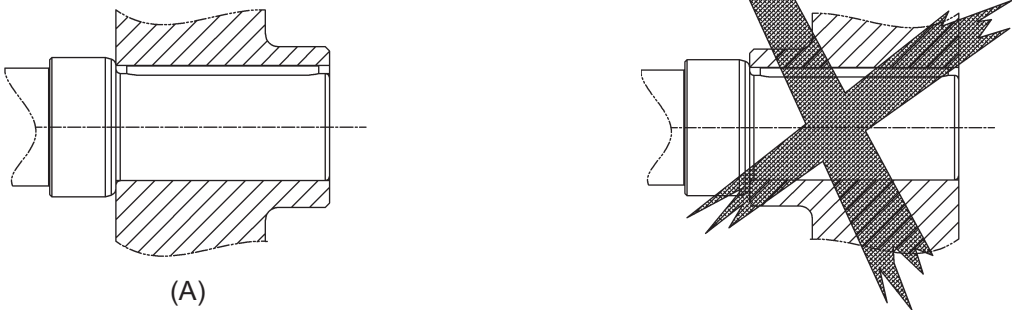
5.1.4 - Installing accessories on solid input and output shafts

Do not use hammers or other tools that might damage the gear unit's shafts or bearings when mounting external parts. Instead, proceed as illustrated in the diagram below:



Bolt (1) and spacer (2) are not included in the consignment.

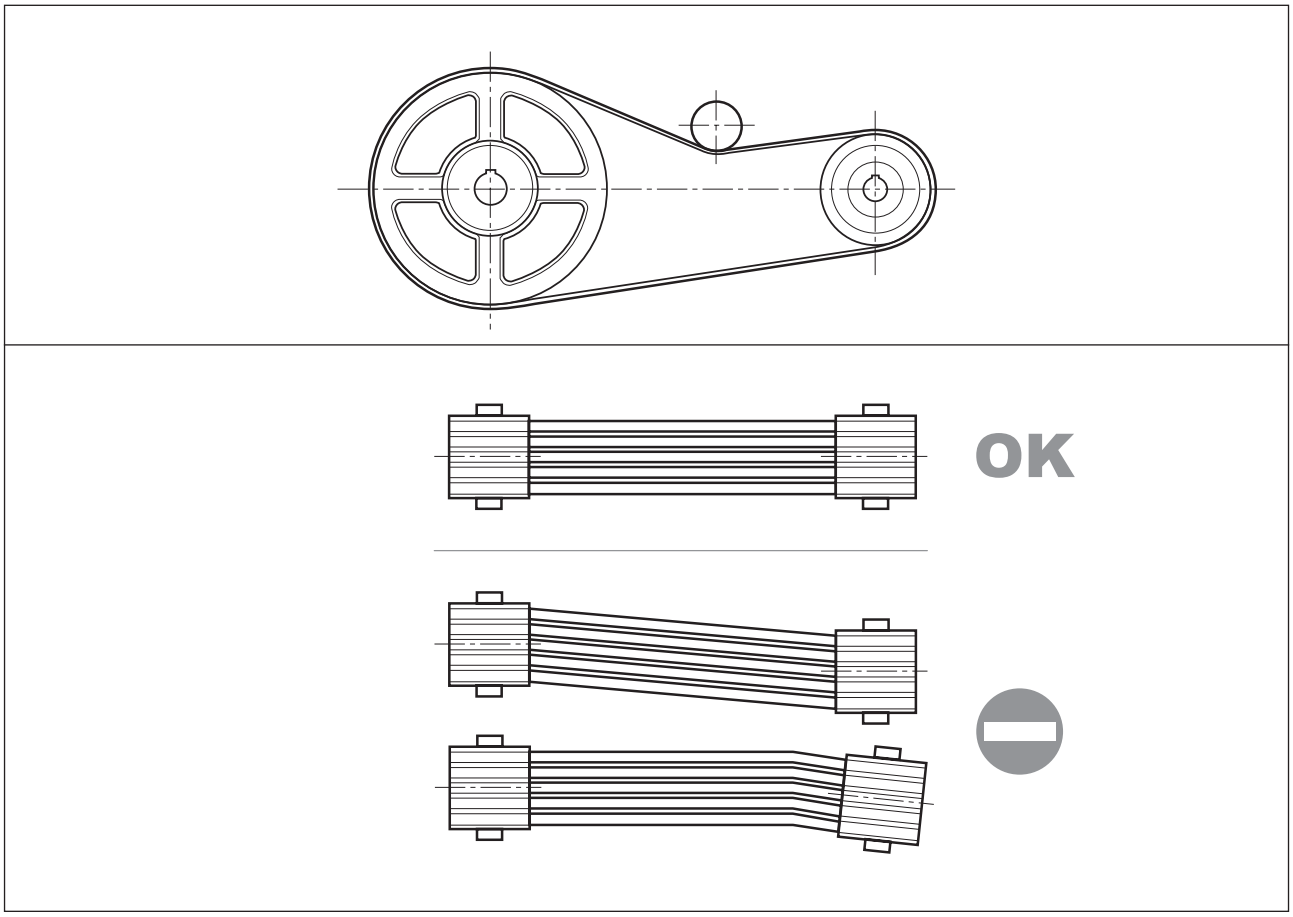
To minimise the loads on the shaft bearings, when mounting transmission mechanisms with asymmetrical hubs use the configuration shown in diagram **(A)** below:



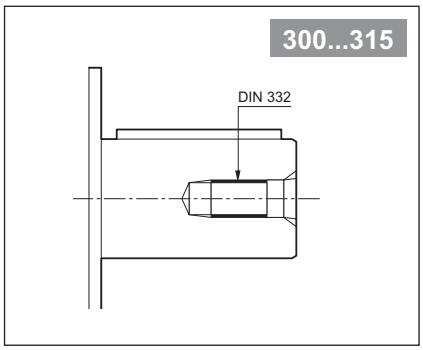
(A)

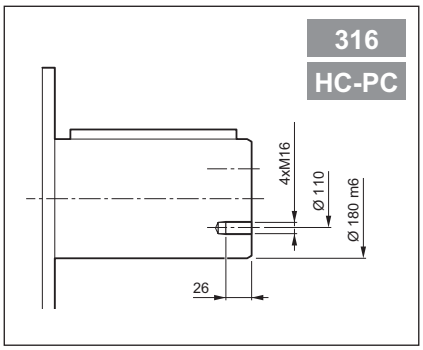
Mounting pulleys

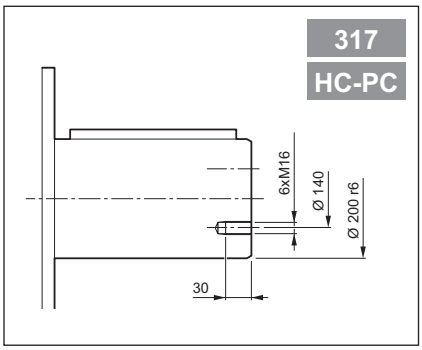
Clean all parts before installing them. When installing belt drive pulleys, the shafts must be parallel with their pulleys aligned.
Do not over tension the drive belt as this can damage the bearings.

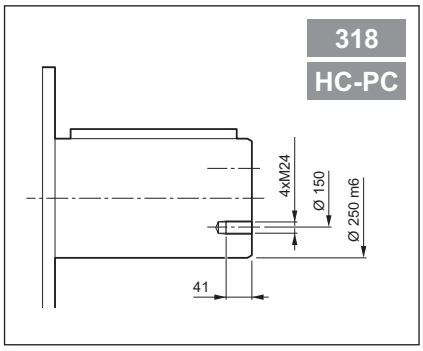


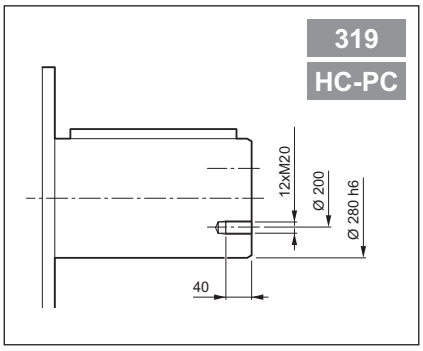
Shaft end: threads

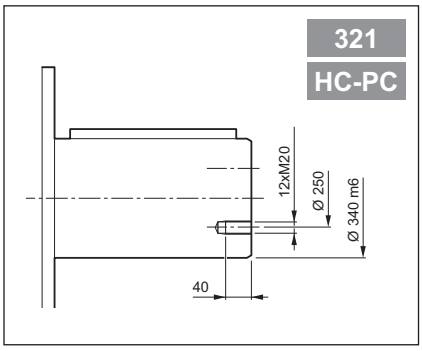








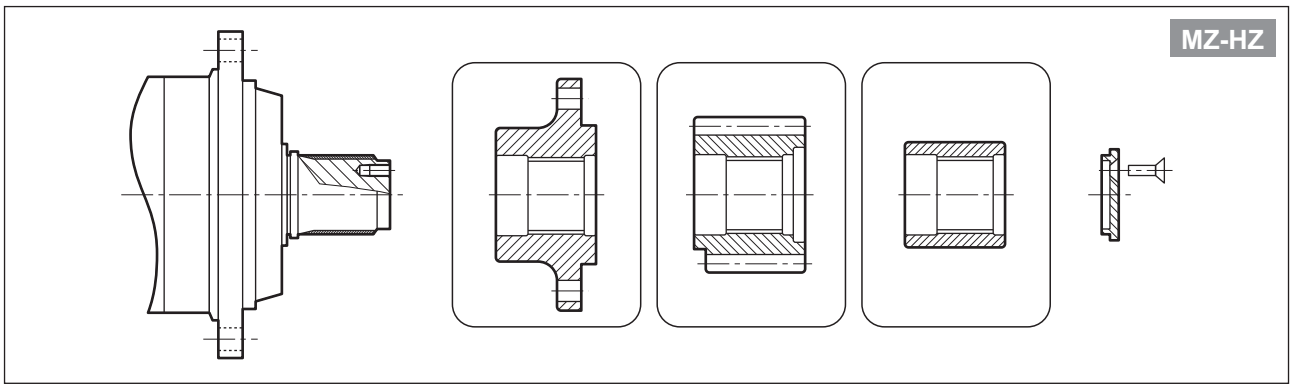




	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
MC	M12	M12	M20	M20	M20	M20	M20	–	–	–	–	–	–	–	–	–	–	–
HC	M16	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	–	–	–	–	–
PC	M12	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	–	–	–	–	–
VK	–	–	M20	M20	M20	M24	M24	M24	M24	M24	M30	M30	M30	–	–	–	–	–

Installing accessories on splined shafts

Do not use hammers or other tools that might damage the gear unit's shafts or bearings when mounting external parts. Instead, proceed as illustrated in the diagram below:

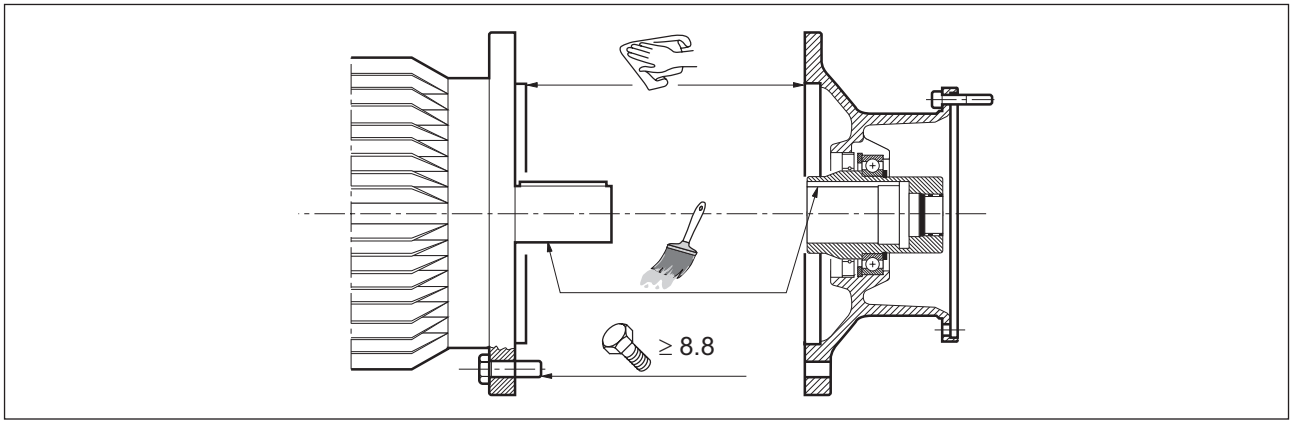


Always use the stop end plate supplied with the gear unit.

5.2 - INSTALLING THE ELECTRIC MOTOR

Further to all the precautions indicated above, when installing a standard IEC 72-1 electric motor, the following precautions must also be observed:

- Do not force the coupling and do not use inappropriate tools during assembly. Take care not to damage the flat/cylindrical coupling surfaces.
- Do not force the rotary coupling mechanisms with heavy overhung or thrust loads.
- To facilitate assembly, use a lubricating synthetic oil paste such as Klüberpaste 46 MR 401 or another product with similar properties and application range.



- **Provided all the above checks have been performed and passed and all other instructions in this manual have been strictly observed, an electric motor with ATEX rating equal to or greater than that of the gear unit may be installed, thus forming a gearmotor which itself complies with the provisions of Directive 94/9/EC.**

  If, instead, the assembly of the motor to the gear unit requires actions other than those prescribed in this Manual or one or more of the manual's prescriptions have not been satisfied, the User shall be responsible for analysing the risks attendant on this particular motor/gear unit combination. The risk analysis is in any case obligatory if the motor is powered by an inverter.

  Only in this way, and subject to self-certification by the assembler, shall the assembly, including the gear unit itself, be compliant with the requirements of Directive 94/9/EC.

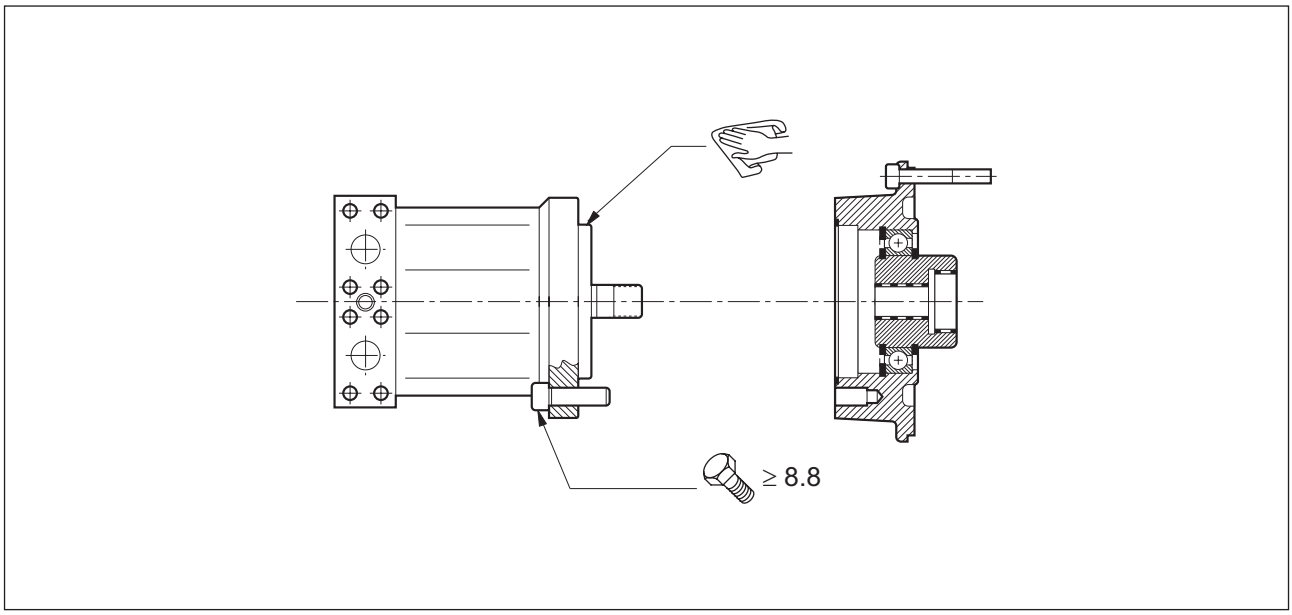
5.3 - INSTALLING THE HYDRAULIC MOTOR

Connecting the hydraulic motor

Remove the protective plug.
Hydraulic motor mountings are available in two versions:

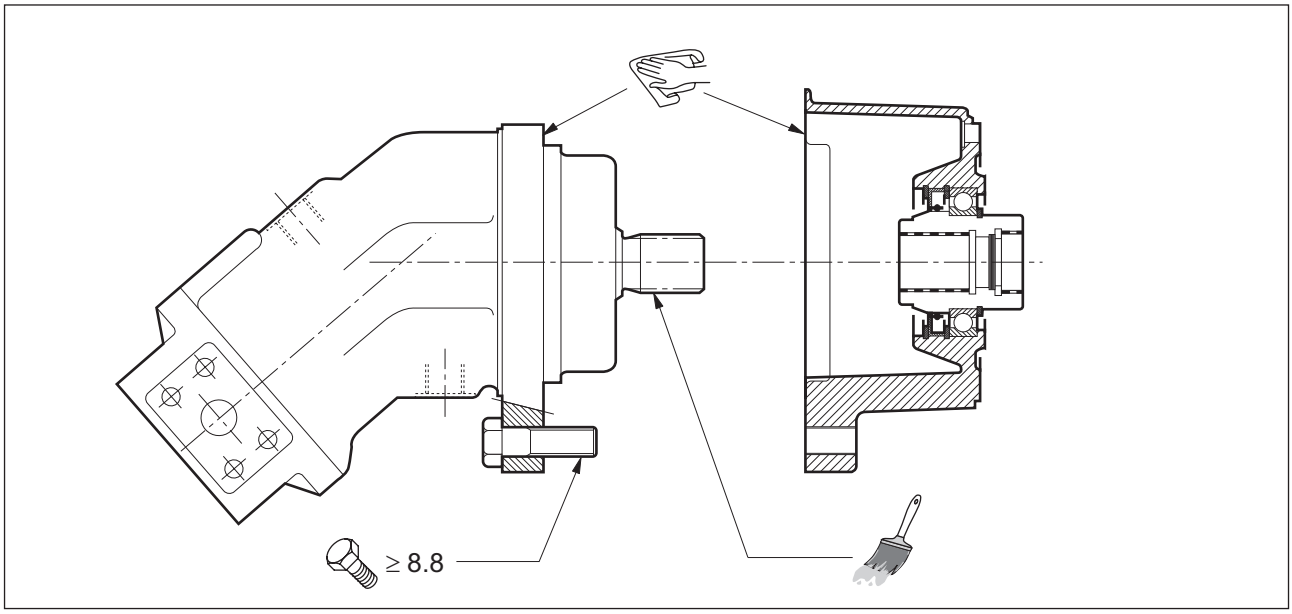
a) Version with O-ring oil gasket between motor flange and gear unit.

In this case, mount the gasket to ensure an oil tight seal between the motor and gear unit, taking care to fit it correctly in its seat without damaging it.



b) Version with gasket already mounted to the coupling.

In this case no special intervention is required to ensure an oil tight seal since this is already provided by the motor coupling. Merely smear the motor shaft with grease.
In both cases, clean the spigot and the coupling where the motor is to be fitted, fit the motor and tighten down the flange mounting bolts.
Always use bolts rated to at least class 8.8.

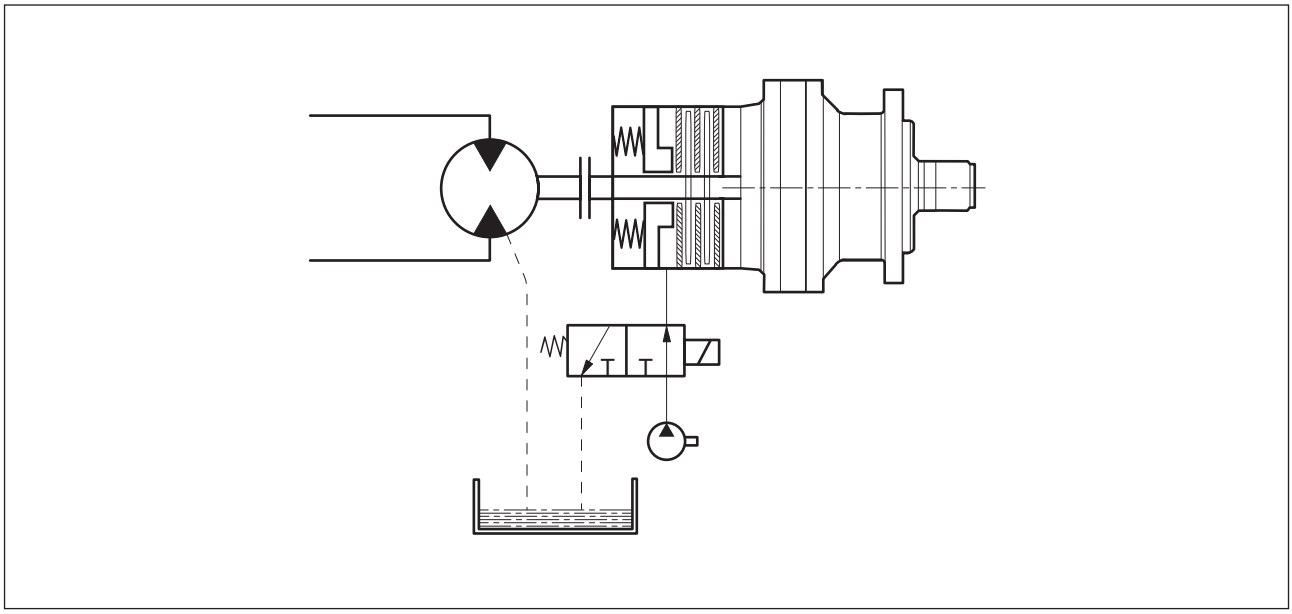


5.4 - CONNECTING THE HYDRAULIC BRAKE

On gear units designed for coupling to hydraulic motors and fitted with a brake, connect the brake control fitting to the hydraulic circuit at the time of assembly.

Start-up

The minimum pressure to release the brake (see chart) must be less than 320 bar.



Technical data

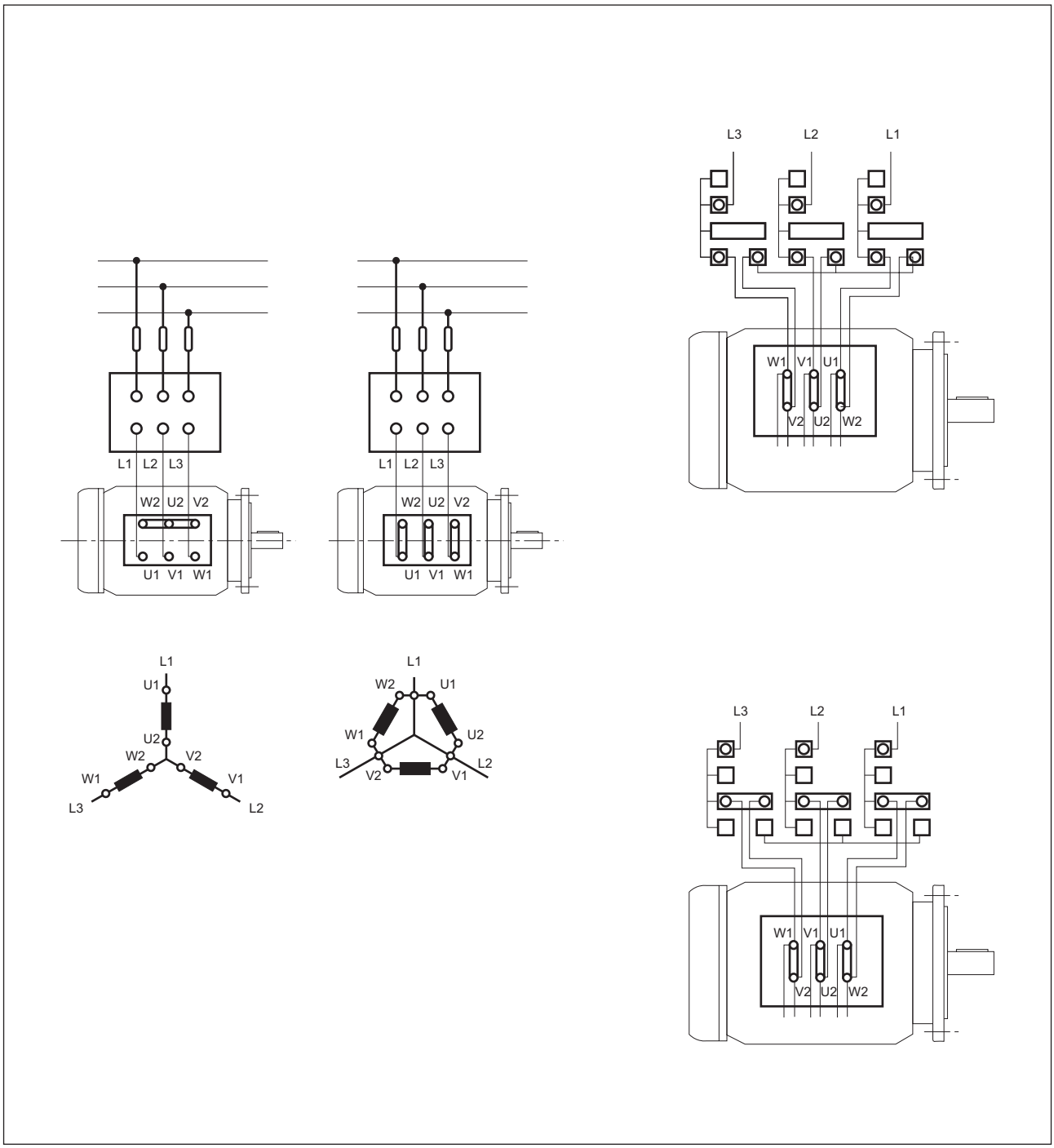
Characteristics \ Brake		4...							5...					6...					
		A	B	D	F	H	K	L	B	C	E	G	K	B	C	E	G	K	L
Braking torque	M_{bs} [daNm]	5	10	16	26	33	40	44	40	50	63	80	100	85	110	150	210	260	320
Minimum release pressure	bar	10	20	30	20	25	30	33	20	27	20	25	32	14	19	25	19	24	28
Max. pressure	bar	320																	
Weight	kg	10							18					35					

NOTE: The static torque M_{bs} is the maximum torque the brake can exert.
Under dynamic loads the braking torque is reduced. The actual M_{bs} values can vary from -5% to +15% of the rating given in the chart.

Installing the gearmotor

If a gearmotor is supplied fully assembled, follow the precautions and instructions given above when mounting to the machine.
For the electrical and hydraulic connection, refer instead to the two sample diagrams below. These are generic only since each specific installation has its own special requirements, which must be evaluated on a per case basis by the Manufacturer.

Drive with electric motor.



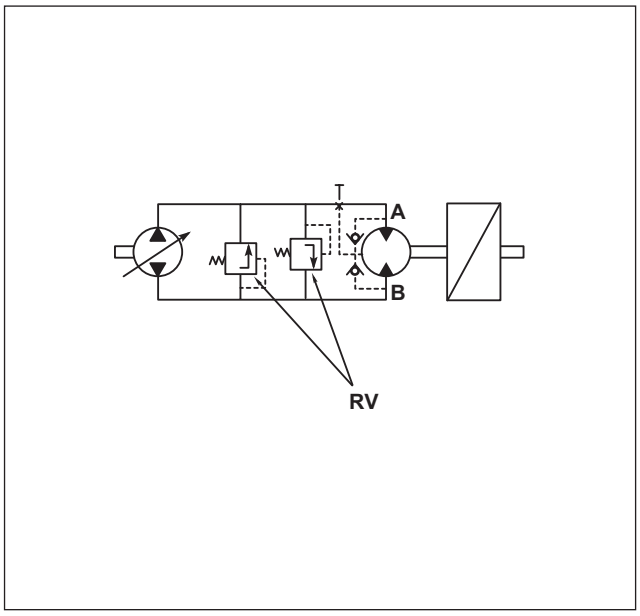
Drive with TRASMITAL MG orbital hydraulic motor

In addition to the instructions governing installation of the gear unit, the following instructions should also be observed when installing a hydraulic motor.

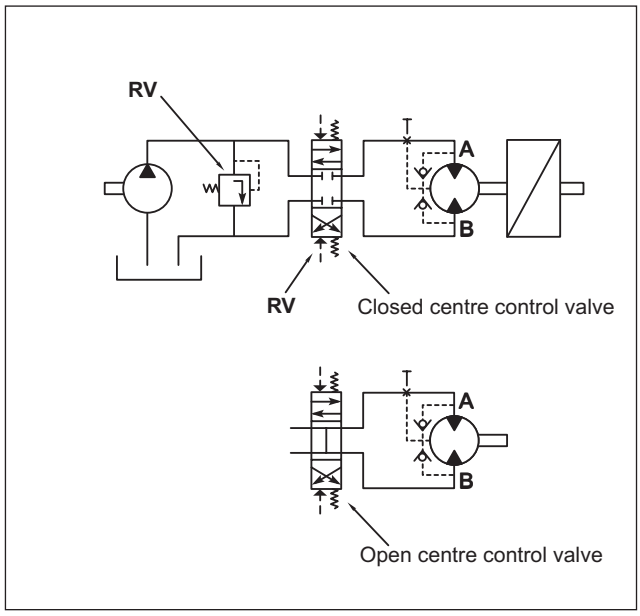
a) Connecting to the hydraulic circuit

The motor can be installed on both a closed and open loop circuit.
In the case of an open circuit installation, the solenoid valve or control valve may be of either the closed centre or open type.
The circuit line corresponding to the hydraulic motor delivery port must always be equipped with a pressure relief valve calibrated to a pressure no greater than the motor's pmax. Refer to the hydraulic circuit diagrams below.

Closed loop circuit

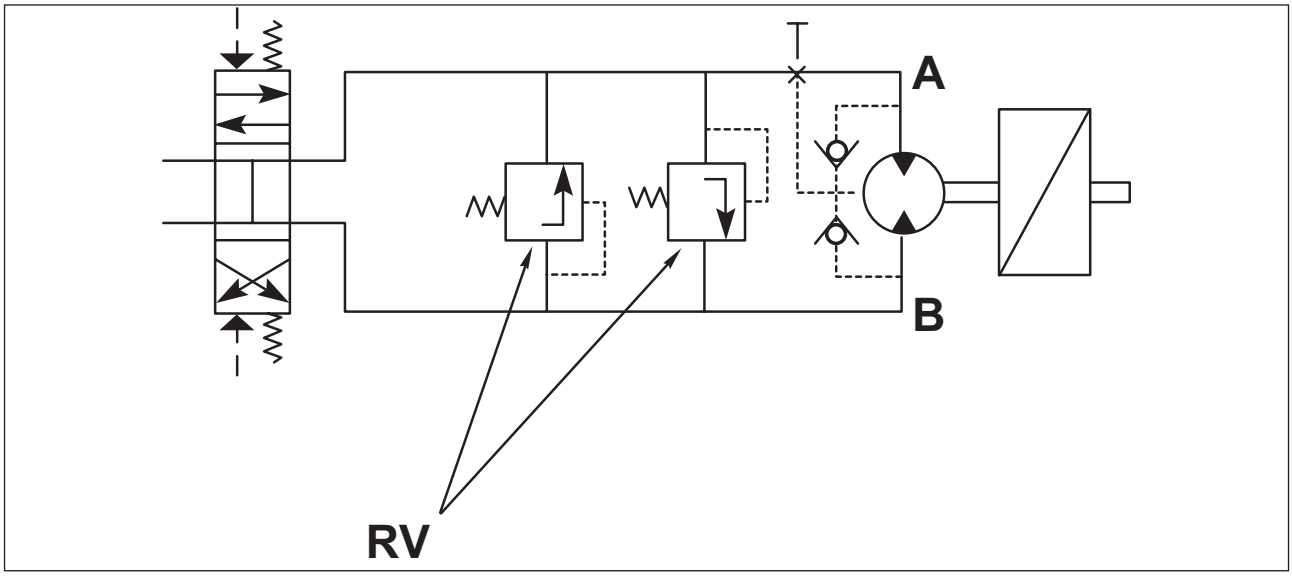


Open loop circuit



RV = pressure relief valves calibrated to pRV < pmax.

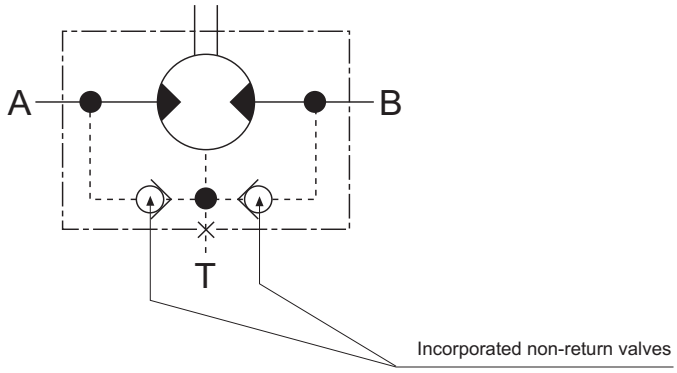
If this is not possible because the circuit must also actuate other equipment at a higher pressure, or the control valve is of the closed centre type and the motor drives components with high inertia, auxiliary pressure relief valves must be installed as close as possible to the motor.



RV = pressure relief valves calibrated to pRV < pmax.

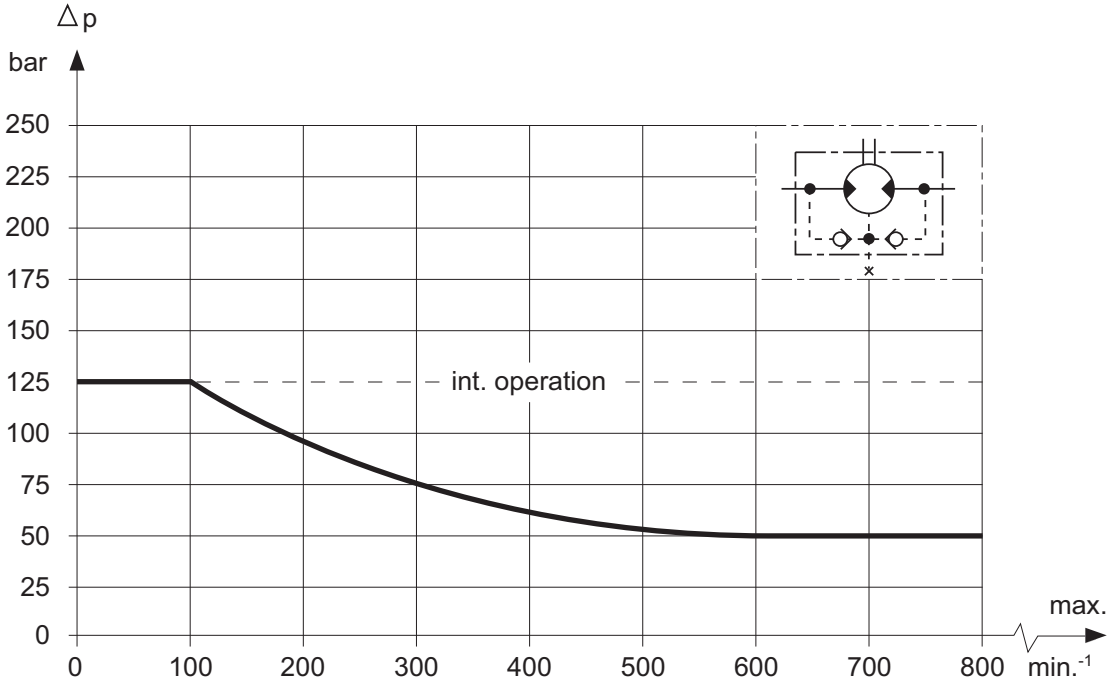
b) Connecting drain port T

These motors have a 1/8" G drain hole in the centre of the cover. The motor is supplied with the port closed by a metal plug (see figure below).
Two non-return valves are incorporated in the motor casing to maintain internal pressure at the same level as the low pressure line A or B if the drain port is not connected to the tank.



1) If the drain port is connected up, pressure at the shaft seal is always equal to the pressure in the drain line.
2) If the drain port is closed off, pressure at the shaft seal never exceeds pressure in the return line.

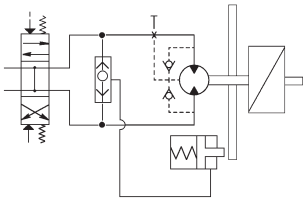
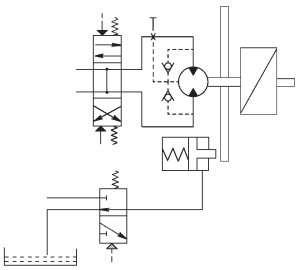
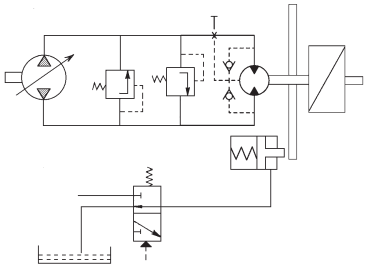
The maximum values for pressure in the drain line (case 1) or return line (case 2) are given in the following figure (for continuous and intermittent operating conditions).



The drain port must always be connected up when more motors are operated in series.

c) Brake control

For gearmotors equipped with brakes, there are two motor versions available, i.e. the B02P or P010 executions.
In the B02P version, the motor has an in-built, direct brake control system.
In the P010 version, an auxiliary branching is required to control the brake.
See the following diagram.

Open loop circuit		Closed loop circuit
Control valve open center type Motor execution **B02P**	Control valve closed center type Motor execution **P010**	Motor execution **P010**
		

d) Hydraulic oil

Use hydraulic mineral oil with viscosity ISO VG 46 (46 Cst at t = 40°C).
It is recommended the oil temperature should be between +30°C and +70°C.

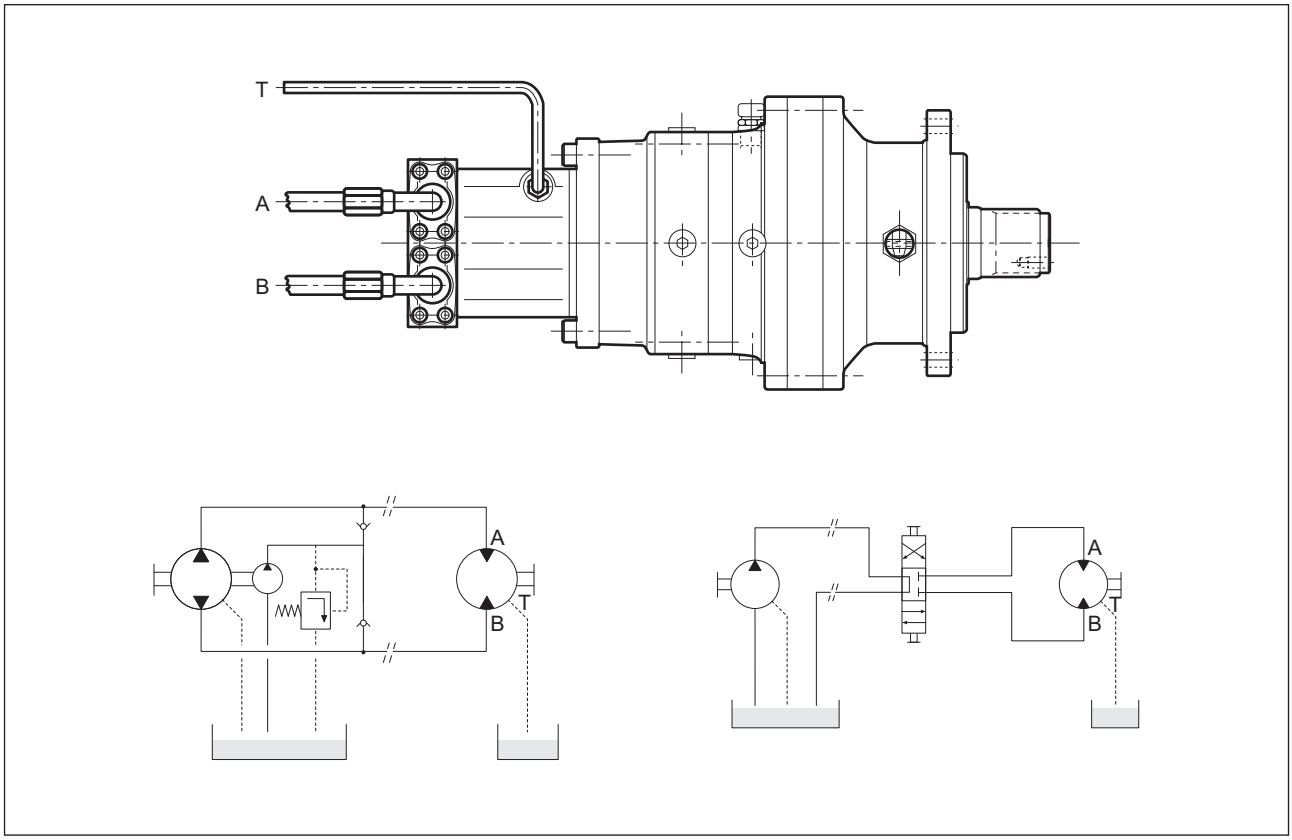
e) Oil filtering

For reliable motor operation and long life, it is important that the hydraulic circuit has a filter for a proper oil filtering according to the following degree:

degree 9 NAS 1638
degree 6 SAE
degree 18/15 SO DIS 4406

Drive with hydraulic motor

All motors must be charged with hydraulic fluid before being operated and during installation.
Position the drain hole so that it is positioned uppermost for charging with fluid.
Make sure the hoses are routed in such a way as to prevent the motor casing from emptying and hence, prevent air pockets from forming which may affect pump suction during operation.



A - B = Supply lines
T = Drainage

5.5 - LUBRICATION

Before starting up the gear unit, it must be charged with lubricant to the level corresponding to its specified mounting position.

The lubricant and its relative viscosity should be selected from the following chart, in accordance with the type of duty and ambient temperature.

If the gear unit is supplied ready charged with lubricant, replace the closed shipping plug with the vent plug included in the shipment before installing it.

(A1)

Plug thread	Pitch	Tightening torque [Nm]
M14	1,5	15 - 20
M16	1,5	15 - 20
M18	1,5	15 - 20
M20	1,5	20 - 30
M22	1,5	20 - 30
M24	1,5	20 - 30
M30	2	30 - 40
M42	3	40 - 50

Plug thread	Pitch	Tightening torque [Nm]
1/8"	28	10 - 15
1/4"	19	10 - 15
3/8"	19	15 - 20
1/2"	14	20 - 30
3/4"	14	20 - 30
1"	11	30 - 40

(A2)

	INDUSTRIAL PLANTS			MOBILE MACHINES	
	ISO standard .. EP grade			SAE standard .. API GL5 grade	
T_a	-10°C / +30°C	+10°C / +45°C	-20°C / +60°C	-20°C / +30°C	+10°C / +45°C
	ISO VG 150	**ISO VG 220**	**ISO VG 150-220**	**SAE 80W/90**	**SAE 85W/140**
AGIP	BLASIA150	BLASIA 220	BLASIA SX 220	ROTRA MP	ROTRA MP
ARAL	DEGOL BG 150	DEGOL BG 220	DEGOL PAS 150-220	GETRIEBEOL HYP	GETRIEBEOL HYP
BP	ENERGOL GR XP 150	ENERGOL GR XP 220	EVERSYN EXP 150-220	HYPOGEAR EP	HYPOGEAR EP
CASTROL	ALPHA SP 150	ALPHA SP 220	ALPHASYN EP 150-220	HYPOY	HYPOY
CEPSA	ENGRANAJES HP 150	ENGRANAJES HP 220	ENGRANAJES HPX 150-220	TRANSMISIONES EP	TRANSMISIONES EP
CHEVRON	N.L. GEAR COMPOUNDS EP 150	N.L. GEAR COMPOUNDS EP 220	TEGRA SYNTHETIC GEAR EP 150-220	RPM UNIVERSAL GEAR LUBRICANTS	RPM UNIVERSAL GEAR LUBRICANTS
ESSO	SPARTAN EP 150	SPARTAN EP 220	SPARTAN S EP 150-220	GEAR OIL GX	GEAR OIL GX
				PONTONIC MP	PONTONIC MP
FUCHS	RENOLIN CKC 150	RENOLIN CKC 220	RENOLIN UNISYN CKC 150-220	TITAN SUPER GEAR	TITAN SUPER GEAR
KLUBER	KLUBEROIL GEM1-150	KLUBEROIL GEM1-220	KLUBERSYNT EG 4-150 / 4-220		
Q8	GOYA 150	GOYA 220	EL GRECO 220		
MOBIL	MOBILGEAR 600 XP 150	MOBILGEAR 600 XP 220	MOBILGEAR SHC XMP 150-220	MOBILUBE HD	MOBILUBE HD
MOLYCOTE	L-0115	L-0122	L-2115 / L-2122		
REPSOL	SUPER TAURO 150	SUPER TAURO 220	SUPER TAURO SINTETICO 150-220		
SHELL	OMALA EP150	OMALA EP220	TIVELA OIL S	SPIRAXHD	SPIRAX HD
TOTAL	CARTER EP 1500	CARTER EP 2200	CARTER SH 150-220	TRANSMISSION TM	TRANSMISSION RS

Polyalphaolefin synthetic oils (PAO)

Brake lubrication

The hydraulic multi-disk brakes are lubricated with the same oil as the gear unit.

Only synthetic lubricants may be used on gear units conforming to European Directive 94/9/EC. Refer to the above chart for the brand and type.

6.0 - TESTING THE GEAR UNIT

The gear unit has been factory tested by the Manufacturer. Before start-up, make sure that:

- the machine incorporating the gear unit complies with the provisions of the “Machinery Directive” 98/37/EC and any other applicable safety legislation
- the gear unit’s mounting position in the installation corresponds to that prescribed and indicated on the nameplate
- the electrical power supply is suitable and operational as prescribed in EN 60204-1, and is grounded as per EN 50014
- the motor’s electric power supply corresponds to that prescribed and is within +/-5% of the rated value
- the hydraulic system is suitable and operational, and the oil in the hydraulic motor’s lubrication circuit conforms to ISO VG 46. It must be filtered with a maximum grade of 10 µm and contamination level less than or equal to class 9 as per NAS 1638 or 18/15 as per ISO/DIS 4406
- there are no signs of lubricant leaks from the plugs or gaskets
- the vent plug is not obstructed by dirt or paint
- the unit does not run noisily or with excessive vibration.

Before starting up the unit, check and make sure that:

- the unit is not assembled in a potentially explosive atmosphere (oil, acid, gas, vapour, radiation) and is free of dust build ups greater than 5 mm in depth
- during operation the gear unit is sufficiently ventilated and is not subject to radiation from external heat sources
- during operation the cooling air does not exceed 40 °C
- the oil level check and filler plugs and the vent plugs are all easily accessible
- all accessories mounted to the gear unit are ATEX certified
- gear units with hollow shafts, with or without shrink disk, have been correctly mounted as described in this manual
- the gear unit has been thoroughly cleaned after installation
- all guards are installed to prevent accidental contact between operators and the unit’s rotary moving parts, and seals are oil tight

7.0 - USING THE EQUIPMENT

Before putting the gear unit into service, the User must ensure that the plant in which it is installed complies with all applicable directives, especially those regarding health and safety at work.

The gear unit may not be used in areas and environments:

- with highly corrosive/abrasive vapours, smoke or dust.
- in direct contact with loose food products.

Danger zones and exposed persons:

The danger zone of the gear unit is the protrusion of the shaft which constitutes a hazard for exposed persons in direct contact with it (crushing, shearing, trapping). In particular, when the gear unit is operating in automatic mode in an accessible area, the shaft must be protected by a guard.

8.0 - MAINTENANCE

Maintenance and replacement work must be carried out by expert maintenance technicians trained in the observance of applicable laws on health and safety at work and the special ambient problems attendant on the installation.

Before doing any work on the unit, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning (due to suspended loads or similar external factors).
Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc).

- Before doing any maintenance work, activate all the safety devices provided and, if necessary, inform persons working in the vicinity. Cordon off the area around the unit and prevent access to any equipment which, if activated, might be the cause of unexpected health and safety hazard.
- Replace worn components with original spare parts.
- Use the lubricants (oil and grease) recommended by the Manufacturer.
- When working on the gear unit always replace all gaskets and seals with original new ones.
- If a bearing requires replacement, it is good practice to also replace the other bearing supporting the same shaft.
- We recommend replacing the lubricating oil after all maintenance work.

The above instructions are aimed at ensuring efficient and safe operation of the gear unit.

The Manufacturer declines all liability for injury to persons and damage to components due to the use of non-original spare parts and non-routine work that modifies the safety requirements without the Manufacturer's express prior authorisation.

Refer to the specific spare parts catalogue when ordering spare parts for the gear unit.

Do not dump polluting liquids, worn parts and maintenance waste into the environment.
Dispose of all such materials as specified by applicable legislation.

- Observe the routine inspection and maintenance schedule to ensure the unit's correct operation and the effectiveness of the explosion protection.
- Always apply fresh Loctite 510 or other product with similar properties and application range to all disassembled threads.
- Before servicing or repairing internal components, allow the gear unit to cool down completely before opening the casing so as to avoid burns from parts which are still hot.
- On completion of maintenance work, make sure that all safety measures and equipment have been applied and reset.
- Clean the gear unit thoroughly after maintenance and repair work.
- On completion of maintenance, tighten all vent, filler and level plugs to their specified torques (chart A1).
- On completion of any maintenance work all seals must be refitted and sealed as prescribed.
- Regardless of the type of gear unit, whenever a seal ring is replaced its lips should be smeared with a thin layer of grease (Fluorocarbon gel 880 ITP or other product with similar properties and application range) before assembly.
- Use only original spare parts for repairs.

8.1 - ROUTINE MAINTENANCE

Keep the gear unit at its maximum efficiency by following the routine maintenance schedule. Good maintenance ensures the unit's maximum performance, extended service life and continued compliance with safety regulations.

(A3)

Frequency	Component	Type of check	Action
at start	Gear unit casing	Check that the external temperature does not exceed 75-80 °C	Stop the machine and contact Bonfiglioli Trasmital's Technical Service
after 200 hrs	Original consignment lubricant	Replace	Replace with new lubricant
	External fasteners	Check locking torque	Tighten down to specified torque
1000 hrs	External seals and gaskets	Check oil level Check for leaks by eye	Service or replace components as required
2500 hrs	Lubricant	Replace	Replace with new lubricant
5000 hrs	Gear unit seals and gaskets	Inspect carefully for wear/ageing of external seals	Replace if aged/worn

For installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme for all surfaces and recesses to avoid dust build-ups of more than 5 mm in depth.

Every 1000 hrs. of operation or after 6 months:

- Measure the surface temperature at the coupling between the gear unit and motor, and at the points which are most shielded from the motor's cooling fan. The maximum temperature must not be more than 75-80°C, nor may this value be exceeded during operation.

Every 5000 hrs. of operation:

- Change the synthetic oil and bearing grease if the gear unit is not life lubricated.
- Replace all externally accessible seal rings unless this has already been done as a result of problems occurring before the scheduled maintenance deadline.

8.2 - OIL CHANGES

1. Place an adequate container under the drain plug.
2. Remove the filler and drain plugs and allow the oil to drain out.

The oil will drain better if it is warm.

3. Wait for a few minutes until all the oil has drained out, then screw the drain plug back on after first changing the plug seal.
4. Fill with new oil until it reaches the level mark. **Do not mix oils of different makes or specifications and check that the oil is highly resistant to foaming and is EP rated**.
5. Tighten down the filler plug after changing its seal.

The gear unit may be supplied with or without lubricant, as requested by the User. The quantity of charge oil required is specified in the Sales Catalogue. This specification is however, approximate, and reference must always be made to the mark on the level plug, the placement of which depends on the mounting position specified in the purchase order.

Life lubricated gear units which are not subject to external contamination do not normally require periodic lubricant changes. If the same type of oil as that already in use is not available, drain the gear unit casing completely and wash its interior thoroughly with a light solvent before refilling with the new lubricant.

If a leak is found, identify the cause of the fault and repair it before topping up the lubricant and operating the unit.

Lubricants, solvents and detergents are toxic/harmful to health:

- they may cause irritation in direct contact with the skin
- they may cause intoxication if inhaled
- they may be fatal if swallowed.

Handle them with care using suitable individual safety equipment. Do not dump them into the environment and dispose of in accordance with applicable legislation.

8.3 - CHECKING OPERATIONAL EFFICIENCY

- Remove any dust from the gear unit and motor casings.
- Check that the noise generated at continuous load does not vary. Excessive vibration or noise can indicate wear of the gear train or failure of a bearing.
- Check the power absorption and voltage against the rated values given on the motor's nameplate.
- Check the wear of the friction surfaces and braking gasket on the brake motors (if fitted) and, if necessary, adjust the gap.
- Check for lubricant leaks from the gaskets/seals, plugs and casings.
- Check all bolted couplings for wear, deformation and corrosion and tighten them down fully, but without over tightening.

8.4 - CLEANING

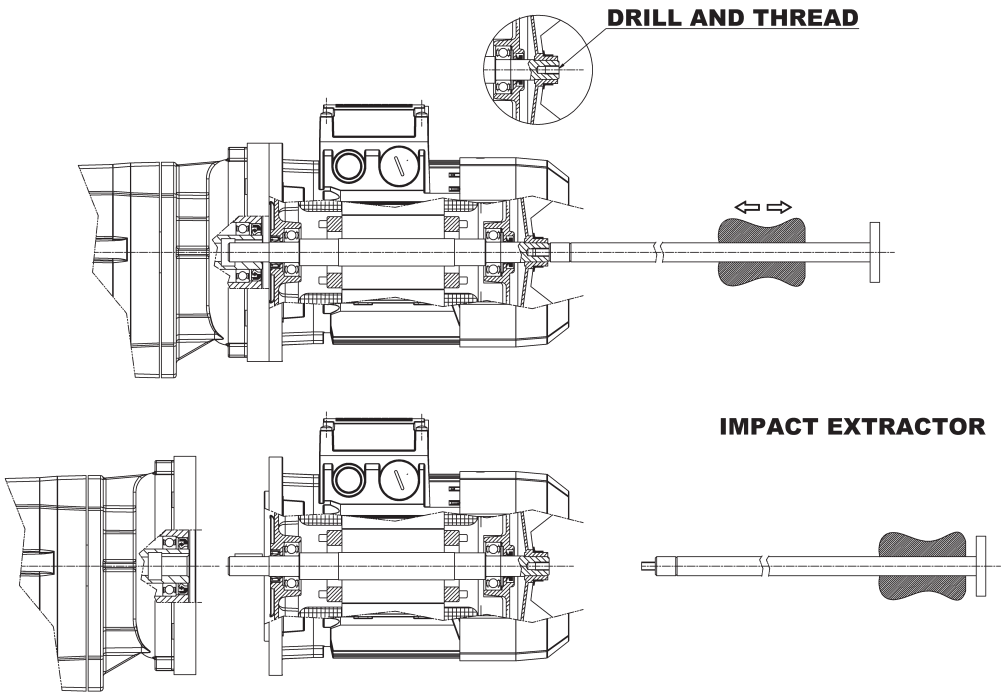
Remove all dust and process waste from the gear unit. Do not use solvents or other products that are incompatible with the unit's construction material and do not direct high pressure jets of water at the gear unit.

9.0 - REPLACING PARTS

- Immediately replace parts and components if they are not able to guarantee safe and reliable operation.
- Never improvise repairs.
- The use of non-original spare parts not only renders the warranty null and void but can jeopardise the gear unit's operation.

9.1 - REMOVING THE MOTOR

If during operation the mobile coupling between the motor and gear unit has not rusted significantly, it should be possible to remove the motor without applying excessive force.
If instead, it proves difficult to remove the motor, do not use screwdrivers or levers to apply force as this may damage the flanges and mating surfaces, but proceed as illustrated below.



1. Drill and thread the motor shaft (fan side).
2. Screw an impact extractor tool into the bore.
3. Undo the bolts fixing the motor to the gear unit.
4. Detach the motor by means of the inertial force of the extractor.

9.2 - DECOMMISSIONING THE GEAR UNIT

The unit must only be taken out of service by operators trained in the observance of applicable laws on health and safety at work.
Do not dump non-biodegradable products, lubricants and non-ferrous materials (rubber, PVC, resins, etc.) into the environment. Dispose of all such materials as stipulated by established environmental legislation.

Do not re-use parts or components which appear to be in good condition after they have been checked or replaced by qualified personnel and declared unsuitable for use.

10.0 - TROUBLESHOOTING

The following information is intended to serve as an aid in locating and eliminating defects and faults. In some cases, problems may be caused by the plant or machine to which the gear unit is assembled and hence, the cause and remedy will be described in the Manufacturer's technical documentation for the machine/plant in question.

FAULT	CAUSE	REMEDY
Bearing temperature too high	Oil level too low	Top up oil level
	Oil spent	Replace oil
	Defective bearings	Contact authorised workshop
Operating temperature too high	Oil level too high	Check oil level
	Oil spent	Replace oil
	Contaminant in oil	Replace oil
Abnormal running noise	Gears damaged	Contact authorised workshop
	Bearing axial backlash too high	Contact authorised workshop
	Bearings defective or worn	Contact authorised workshop
	Excessive load applied	Correct load to rated values given in Sales Catalogue
	Contaminant in oil	Replace oil
Abnormal noise at gear unit mounting	Mounting bolts loose	Tighten bolts to specified torque
	Mounting bolts worn	Replace bolts
Oil leaks	Oil level too high	Check oil level
	Casing/coupling seals inadequate	Contact authorised workshop
	Gaskets worn	Contact authorised workshop
Gear unit does not run or runs with difficulty	Oil viscosity too high	Replace oil (see recommended lubricant chart)
	Oil level too high	Check oil level
	Excessive load applied	Redesign drive for actual load required
Output shaft does not turn with motor running	Gears damaged	Contact authorised workshop

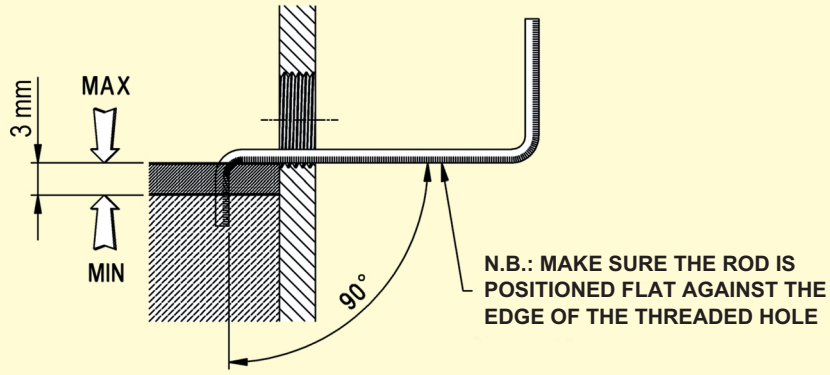
ANNEX 1 - CHECKING THE OIL LEVEL ON ATEX-SPECIFIED GEAR UNITS

Gear units are normally fitted with oil level check plugs.

To check the oil level, first identify the level plug.

- **Horizontal position**:
  Remove the plug and insert a bar of the right size in the hole and of the shape shown in the figure.
- **Vertical position**:
  Use a rod to check that the oil level is between the MIN and MAX marks, then screw the plug back in.

If the level is more than 3 mm below the spill level, top up and check the reason for the drop in oil level.



Gear units conforming to Directive 94/9/EC and designed for a vertical mounting position, are normally equipped with an oil expansion chamber fitted with service plugs for filling, checking the oil level and venting internal overpressure.

ANNEX 2 - LUBRICANT CHARGE QUANTITY

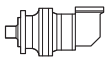
3_L Series

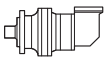
		Mounting position		
		A	T	O
300	L1	0.6	1.0	0.9
	L2	0.9	1.3	1.2
	L3	1.2	1.6	1.5
	L4	1.5	1.9	1.8
301	L1	0.8	1.2	1.1
	L2	1.1	1.5	1.4
	L3	1.4	1.8	1.7
	L4	1.7	2.1	2.0
303	L1	1.3	2.3	2.0
	L2	1.6	2.6	2.3
	L3	1.9	2.9	2.6
	L4	2.2	3.2	2.9
304	L1	1.4	2.4	2.2
	L2	1.9	2.9	2.7
	L3	2.2	3.2	3.0
	L4	2.5	3.5	3.3
305	L1	1.6	2.6	2.4
	L2	2.1	3.1	2.9
	L3	2.4	3.4	3.2
	L4	2.7	3.7	3.5
306	L1	2.5	3.5	3.2
	L2	3.3	4.3	4.0
	L3	3.6	4.6	4.3
	L4	3.9	4.9	4.6
307	L1	3.5	5.0	4.5
	L2	4.5	6.0	5.5
	L3	5.0	6.5	6.0
	L4	5.3	6.8	6.3
309	L1	4.0	5.5	5.0
	L2	5.0	6.5	6.0
	L3	5.5	7.0	6.5
	L4	5.8	7.3	6.8

		Mounting position		
		A	T	O
310	L1	5.0	6.5	6.0
	L2	6.3	7.8	7.3
	L3	7.1	8.6	8.1
	L4	7.4	8.9	8.4
311	L1	7.0	12	10
	L2	9.0	14	12
	L3	10	15	13
	L4	11	16	14
313	L1	9.0	14	12
	L2	12	17	15
	L3	13	18	16
	L4	13	18	16
314	L2	17	25	21
	L3	19	27	23
	L4	20	28	24
315	L2	19	27	23
	L3	21	29	25
	L4	22	30	26
316	L2	22	30	26
	L3	24	32	28
	L4	25	33	29
317	L2	26	41	36
	L3	29	44	39
	L4	30	45	40
318	L3	40	55	50
	L4	43	58	53
319	L3	50	70	60
	L4	53	73	63
321	L3	56	76	66
	L4	60	80	70

N.B. Oil quantities are indicative. Check actual level after filling through the appropriate plug.

3_R Series

		Mounting position		
		B0	U_	P_
300	R2	1.2	1.7	1.5
	R3	1.5	2.0	1.8
	R4	1.8	2.3	2.1
301	R2	1.6	2.1	1.9
	R3	1.9	2.4	2.2
	R4	2.2	2.7	2.5
303	R2	2.2	2.8	2.6
	R3	2.5	3.1	2.9
	R4	2.8	3.4	3.2
304	R2	2.3	2.9	2.7
	R3	2.8	3.4	3.2
	R4	3.1	3.7	3.5
305	R2	2.5	3.1	2.9
	R3	3.0	3.6	3.4
	R4	3.3	3.9	3.7
306	R2	4.0	5.0	4.8
	R3	4.8	5.8	5.6
	R4	5.1	6.1	5.9
307	R2	6.0	8.0	7.0
	R3	7.0	9.0	8.0
	R4	7.5	9.5	8.5

		Mounting position		
		B0	U_	P_
309	R2	6.5	8.5	7.5
	R3	7.5	9.5	8.5
	R4	8.0	10	9.0
310	R2	13	15	14
	R3	11	13	12
	R4	12	14	13
311	R2	14	19	17
	R3	16	21	19
	R4	17	22	20
313	R2	16	21	19
	R3	19	24	22
	R4	20	25	23
314	R3	25	33	29
	R4	28	36	32
315	R3	27	35	31
	R4	30	38	34
316	R3	30	38	34
	R4	33	41	37
317	R3	38	52	48
	R4	42	56	52
318	R4	48	63	58

N.B. Oil quantities are indicative. Check actual level after filling through the appropriate plug.

	[l]											
	AA - EA - FD			**AF - EF - FE**		**AE - EE - FF**		**AD - ED - FA**		**TA - TE - TF TD - VA - VE VF - VD**		**OA - OE - OF OD - QA - QE QF- QD**	
		input			input		input		input		input		input
		P(IEC)	**HS**		**P(IEC) HS**		**P(IEC) HS**		**P(IEC) HS**		**P(IEC) HS**		**P(IEC) HS**
3/V 00 L3	0.9	0.12	0.12	0.9	0.12	0.9	0.12	0.9	0.12	1.3	0.12	1.2	0.12
3/V 01 L3	1.1			1.1		1.1		1.1		1.5		1.4	
3/V 03 L3	1.6	0.25	0.25	1.6	0.31	1.6	0.31	1.6	0.38	2.6	0.31	2.3	0.25
3/V 04 L3	1.9	0.38	0.38	1.9	0.43	1.9	0.43	1.9	0.52	2.9	0.52	2.7	0.38
3/V 05 L3	2.1			2.1		2.1		2.1		3.1		2.9	
3/V 06 L3	3.3	0.64	0.64	3.3	0.76	3.3	0.76	3.3	0.85	4.3	0.76	4	0.76
3/V 10 L4	7.1			7.1		7.1		7.1		8.6		8.1	
3/V 07 L3	4.5	2.4	2.8	4.5	2.6	4.5	2.6	4.5	1.7	6	1.9	5.5	1.9
3/V 11 L4	10			10		10		10		15		13	
3/V 13 L4	13			13		13		13		18		16	
3/V 09 L3	5	4.3	4.5	5	3.9	5.0	3.9	5	3.0	6.5	3.5	6	3.5
3/V 10 L3	6.3			6.3		6.3		6.3		7.8		7.3	
3/V 14 L4	19			19		19		19		27		23	
3/V 15 L4	21			21		21		21		29		25	
3/V 16 L4	24			24		24		24		32		28	
3/V 11 L3	9	7.8	9.6	9	6.7	9	6.7	9	5.0	14	5.5	12	5.5
3/V 13 L3	12			12		12		12		17		15	
3/V 14 L3	17			17		17		17		25		21	
3/V 17 L4	29			29		29		29		44		39	
3/V 15 L3	19	11	15	19	8.9	19	9.4	19	7.5	27	9.5	23	9.5
3/V 18 L4	40			40		40		40		55		50	
3/V 19 L4	50			50		50		50		70		60	
3/V 16 L3	22	23	28	22	16.8	22	17.5	22	10.7	30	17	26	17
3/V 17 L3	26			26		26		26		41		36	
3/V 21 L4	56			56		56		56		76		66	

Life lubrication

NOTE: In combined gear units, lubrication of the planetary stage is separate from that of the worm (3/V) or helical bevel (3/A) stages.

	oil [l]											
	AA - EA - FD		**TA - TE - TF TD- VA - VE VF - VD**		**OA - OE - OF OD - QA - QE QF- QD**		**AD - ED - FA**		**AF - EF - FE**		**AE - EE - FF**	
3/A 00 L2	0.60	1.4	1.0	1.4	0.9	1.4	0.6	1.4	0.6	1.4	0.6	1.4
3/A 01 L2	0.80	2.3	1.2	2.3	1.1	2.3	0.8	2.3	0.8	2.3	0.8	2.3
3/A 03 L2	1.3	3.2	2.3	3.2	2.0	3.2	1.3	3.2	1.3	3.2	1.3	3.2
3/A 04 L2	1.4	3.8	2.4	3.9	2.2	3.9	1.4	4.5	1.4	5.0	1.4	4.2
3/A 05 L2	1.6	4.0	2.6	4.1	2.4	4.1	1.6	4.7	1.6	5.2	1.6	4.4
3/A 06 L2	2.5	4.9	3.5	8.1	3.2	4.7	2.5	8.4	2.5	11	2.5	9.2
3/A 07 L2	3.5	6.8	5.0	8.1	4.5	12	3.5	15	3.5	18	3.5	15

Life lubrication

NOTE: In combined gear units, lubrication of the planetary stage is separate from that of the worm (3/V) or helical bevel (3/A) stages.

INDEX OF REVISIONS (R)

R2

090320

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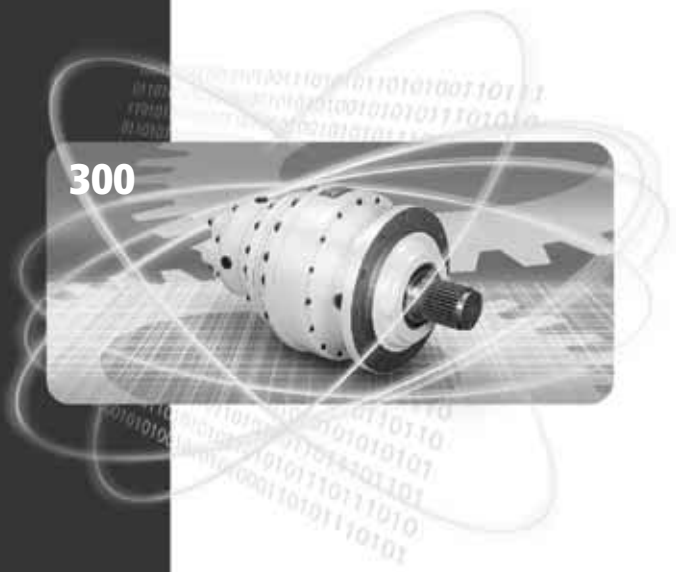

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